PEL 285- Proposed Reservoir Coreholes

Review of Environmental Factors

Prepared for AGL Upstream Investments Pty Ltd| 21 November 2011

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Final

Report | Prepared for AGL Upstream Investments Pty Ltd |21 November 2011

Prepared by	**Andrew Wiltshire**	Approved by	**Duncan Peake**
Position	Environmental Scientist	Position	Senior Associate
Signature		Signature	
Date	21 November 2011	Date	21 November 2011

Document Control

Version	Date	Prepared by	Reviewed by
V1	August 2011	Andrew Wiltshire	Darren Holloway
V2	September 2011	Andrew Wiltshire	Duncan Peake
V3	October 2011	Andrew Wiltshire	Duncan Peake
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Table of Contents

Table of Contents *(Cont'd)*

Table of Contents

Table of Contents

Photographs

Figures

Tables

Tables

Appendices

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1 Introduction

1.1 Purpose of the REF

This Review of Environmental Factors (REF) has been prepared by EMGA Mitchell McLennan Pty Ltd (EMM) on behalf of AGL Upstream Investments Pty Ltd (hereafter AGL) for the drilling of proposed reservoir coreholes south of Gloucester. This REF considers three scenarios, of which only one will be chosen, for the drilling of the proposed coreholes to further test coal seam gas (CSG) characteristics and to define methane resources in Petroleum Exploration Licence No. 285 (PEL 285). The drilling of these reservoir coreholes form part of the work program requirements outlined in PEL 285. PEL 285 is shown in Figure 1.1.

The proposed drilling activities will involve the drilling of only one of the following scenarios:

- Scenario 1 - two reservoir coreholes (PL01 and PL02), to depths of approximately 400 m and 500 m respectively; or
- Scenario 2 - one reservoir corehole (PL03), to a depth of approximately 800 m; or
- Scenario 3 - one reservoir corehole (PL05), to a depth of approximately 800 m.

Proposed activities also include the proposed installation of up to two vibrating wire peizometers (VWPs) at the final drill site, with the exception of PL05 which would be cased and suspended as a future production well pending further planning and environmental approvals.

PL01 and PL02 are located on a property owned by the proponent, known as 'Tiedmans'. PL03 and PL05 are located on privately owned land consisting of cleared grazing pasture. A map of the location of the four proposed reservoir coreholes is presented in Figure 1.2.

PEL 285 is located within the local government areas (LGAs) of Great Lakes, Dungog and Gloucester. In accordance with the licence conditions issued for PEL 285 under Part 3 of the NSW *Petroleum (Onshore) Act 1991*, the proposed reservoir coreholes are classified as a Category 3 activity. A Category 3 activity requires the licence holder to notify the NSW Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) of that activity, and in most circumstances, submit an assessment of the activity in accordance with Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The REF describes the proposal, documents the potential impacts, and details protective measures to be implemented. It has been prepared pursuant to section 111 of the EP&A Act and clause 228 of the NSW Environmental Planning and Assessment Regulation 2000 (EP&A Regulation). Other relevant legislation has also been considered, including but not limited to the NSW *Threatened Species Conservation Act 1995* (TSC Act), NSW *National Parks and Wildlife Act 1974* (NPW Act), NSW *Protection of the Environment Operations Act 1997* (POEO Act) and the Commonwealth Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In doing so, the REF fulfils the requirements of section 111 of the EP&A Act, so that the responsible consent authority, in this case the Minister for Mineral Resources, can examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity in determining the proposal.

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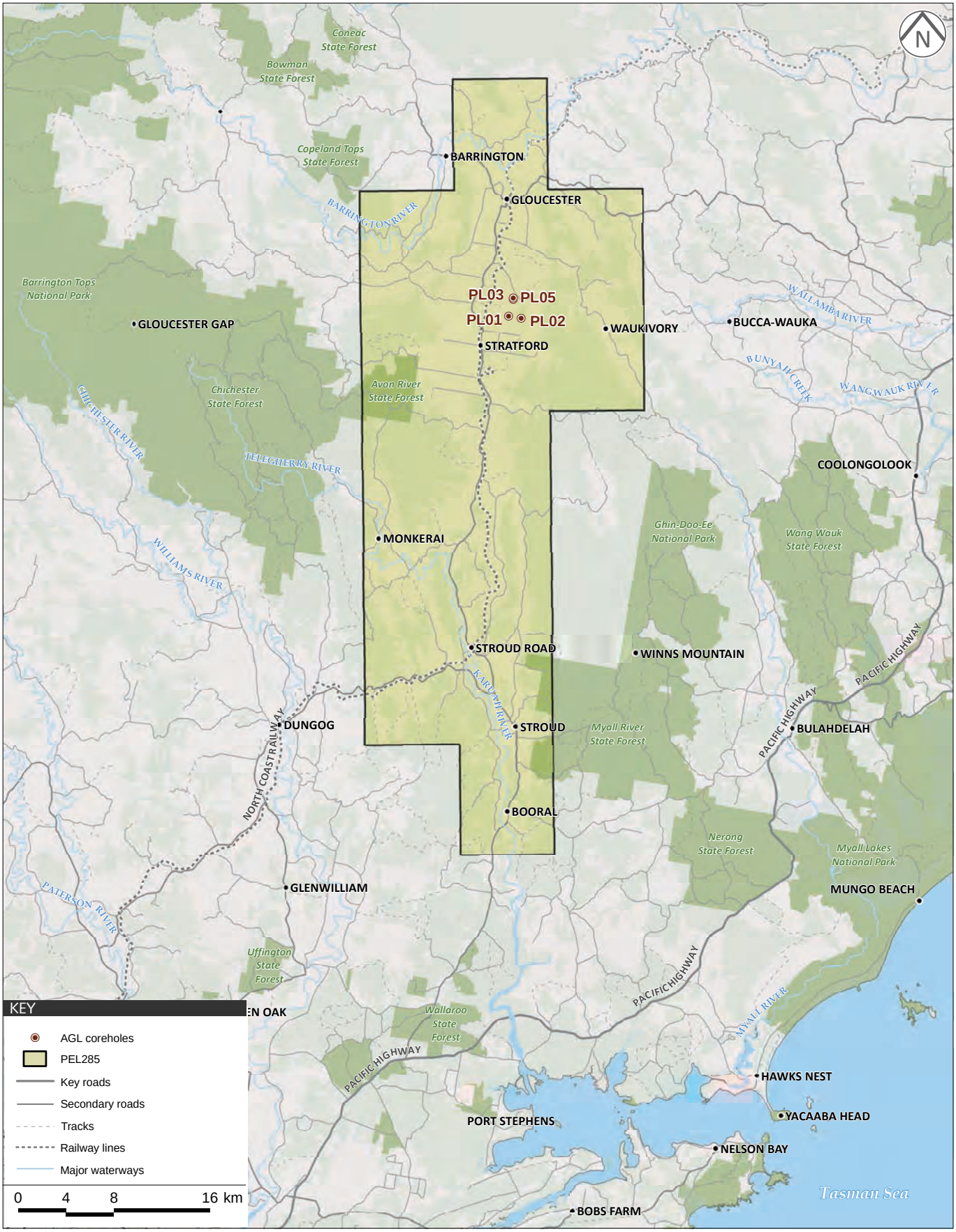

PEL285

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1.2 Site description

The proposed reservoir coreholes are all located south of Gloucester and to the north east of the township of Stratford. PL01 and PL02 are located at 'Tiedmans', which is a property owned by the proponent. PL03 and PL05 are located on privately-owned land adjacent to 'Tiedmans', to the south of Fairbairns Road, which is approximately six kilometres (km) south of Gloucester town centre. Figure 1.2 identifies the proposed locations of the reservoir coreholes. PL01 and PL02 are proposed on Lot 83 979859. PL03 and PL05 are proposed on Lot 2 DP 1040412, in the locality of Forbesdale.

1.3 Zoning

Within the Gloucester Local Environmental Plan 2010 (LEP) the subject lots are zone RU1 Primary Production. The objectives of the RU1 zone are:

- to encourage primary sustainable industry production by maintaining and enhancing the natural resource base;
- to encourage diversity in primary industry enterprises and systems appropriate for the area;
- to minimise the fragmentation and alienation of resource lands;
- to minimise conflict between land uses in this zone and land uses within adjoining zones; and
- to encourage eco tourism enterprises that minimise any adverse effect on primary industry production and the scenic amenity of the area.

An assessment of the ecological and biodiversity impacts is presented in Section 5 which identifies that the proposed reservoir coreholes (and VWPs) would not have a long term significant impact on the environment.

Under the provisions of the Gloucester LEP the proposed activities are technically prohibited in the RU1 zone, however, the provisions of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP) for petroleum exploration override the LEP provisions. Under the Mining SEPP the proposed reservoir coreholes are permitted without consent, although an REF is required due to the proposed activity being subject to Part 5 of the EP&A Act, in accordance with the requirements of the PEL.

1.4 Ownership

The four proposed reservoir coreholes are located on privately-owned land approximately 7.5 km south of Gloucester township. The northern parcel, on which PL03 and PL05 are located, is owned by an individual landholder. The southern parcels, on which PL01 and PL02 are located, are owned by the proponent. Access to the lots and landholder's permission to undertake the proposed works on the privately owned land has been negotiated by the proponent.

1.5 Overview of PEL 285

PEL 285 was granted in 1992 under the NSW *Petroleum (Onshore) Act 1991*. In 2008, AGL acquired PEL 285 from the Lucas Energy and Molopo Joint Venture to become the sole operator. The licence enables investigation of the exploration of petroleum within the licence area. Since 1992, the Lucas-

Molopo Joint Venture conducted a number of environmental investigations regarding exploration activities undertaken. These investigations have provided important baseline material for the PEL.

1.6 Gloucester Gas Project

Concept approval of the Gloucester Gas Project (GGP) was approved by the NSW Planning Assessment Commission (PAC) in February 2011 under Part 3A of the EP&A Act. A number of environmental investigations were undertaken as part of this project and have been used as background material for this REF. In addition, exploration activities within the GGP are not covered by the Part 3A approval and as such are required to be considered under Part 5 of the EP&A Act. The GGP is situated within PEL 285, and in proximity to the proposed reservoir coreholes. The GGP primarily involves four integrated components:

- Gas Field Development Area (GFDA) – development of producing wells and associated infrastructure within the Concept Area and Stage 1 GFDA;
- Central Processing Facility (CPF) – compression of gas up to 30 petajoules per year with an 80 terajoule/day average, water treatment facility including associated storage and evaporation ponds, small scale ancillary power generation facility, and other ancillary infrastructure;
- Gas Transmission Pipeline - high pressure gas pipeline from Stratford to Hexham; and
- Hexham Delivery Station - custody transfer point for CSG from the pipeline to the Sydney Newcastle trunk pipeline.

Project approval has been granted by the NSW PAC for:

- up to 110 well site locations within the Stage 1 GFDA of the Concept Area, including access roads, gas and water gathering system and other associated infrastructure;
- construction and operation of the CPF (up to 30 PJ per year with an average of 80 TJ per day) including a water treatment facility, storage ponds and an evaporation pond, 15 MW ancillary power generation facility and associated infrastructure within the Stage 1 GFDA;
- construction and operation of the gas pipeline from the CPF at Stratford to Hexham; and
- Hexham Delivery Station to transfer gas to market.

Gas from the GGP would produce at 20 to 30 PJ per annum, which is more than 10% of the existing NSW market. This represents the additional gas demand growth projected for the underlying NSW gas market over the next three to four years (excluding fuel for power generation). CSG from the GGP would be delivered into the existing NSW gas market through the pipeline connection into the existing Newcastle/Sydney gas network at Hexham.

1.7 Overview of proposed activities

The proposed activities include the drilling of one of three reservoir corehole scenarios. The scenarios are as follows:

- Scenario 1: the drilling of two reservoir coreholes (PL01 and PL02) to depths of 400 m and 500 m respectively;

- Scenario 2: the drilling of a reservoir corehole (PL03), to a depth of 800 m; or
- Scenario 3: the drilling of a reservoir corehole (PL05), to a depth of 800 m.

Proposed activities also include the installation of up to two VWPs at the final drill site, with the exception of PL05 which would be cased, cemented and suspended as a potential future production well pending further planning and environmental approvals.

It is expected that proposed reservoir corehole activities will take up to approximately four weeks to complete at each site. The proposed works are anticipated to begin in January 2012. Drilling will take place 24 hours a day for up to three weeks.

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Integrated Design Solutions | 030556 Rev D - 18 October 2011

Proposed reservoir coreholes

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2 Proposed activities

2.1 Site layout

The drilling activities at each reservoir corehole site would involve temporary ground surface disturbance of an area up to approximately 70 m x 60 m (PL03 and PL05) or 35m x 20m (PL01 and PL02). An indicative site layout for the proposed drilling activities is shown in Figure 2.1.

Tanks would be provided for storage of water for circulation at each drilling site. The water will be delivered to the site by a local contractor. This water will be stored on site and disposed of at 'Tiedmans', a property owned by the proponent, or a licensed facility. Truck movements associated with water delivery and disposal to and from the proposed drill sites is discussed in Section 5.11. Likely amounts of water required are described in Section 2.4.8 below.

Stock proof fencing will be employed to delineate the works area and to limit the extent of disturbance. Transportable laboratories/office's (approximately 2.4 m x 3.6 m) will be installed on-site during the drilling operations. Following the cessation of drilling, up to two VWP(s) are proposed to be installed at the final drill site. However, should the proponent drill PL05, this reservoir corehole will be cased, cemented and suspended for future production pending further planning and environmental approvals following the cessation of drilling.

2.2 Access

Access to the drill site will be required on a regular basis during drilling and openhole wireline logging operations. Access to the properties will be via public roads and internal property roads as agreed with the landholder. Wherever practicable, existing roads and tracks shall be used. These tracks will be upgraded in consultation with the landholder. Access objectives are to:

- minimise disturbance to soils, native vegetation and fauna;
- minimise impacts to natural drainage patterns;
- minimise disruption to landholders; and
- avoid adverse impacts to existing cultural and heritage amenity.

Generally, the proposed upgrades would involve a maximum disturbance width of 4 m along the upgraded length, 3 m of which would be actual track. The surface would be levelled and potentially covered with a compacted layer of gravel. Field trials are currently being undertaken by AGL as to the use of alternative methodologies to upgrade the access track and pads. This may involve the folding back of the topsoil and the installation of a load bearing plastic mesh onto the subsurface clay structure. The topsoil is then replaced and seeded with grasses.

Access to PL01 and PL02 will be by existing access routes at the 'Tiedmans' property, which is via Fairbairns Road and Tiedmans Lane. Access to PL03 and PL05 will require the construction of a recessed gate along Tiedmans Lane to allow for vehicles to safely enter and exit the work site. These access roads are shown on Figure 1.2.

2.3 Activity duration and working times

The drill activity for each reservoir corehole would typically occur over a period of about one to three weeks, depending upon site conditions. It is proposed to undertake 24 hour drilling operations at each of the proposed reservoir coreholes due to the local geology and conditions. Openhole wireline logging would be undertaken over a two day period at the reservoir coreholes once drilling has been completed.

The drilling sites would be rehabilitated after all drilling activities have ceased.

2.4 Drilling

2.4.1 General

The proposed coreholes will be drilled in accordance with the conditions in PEL 285.

It is anticipated that the drilling will be undertaken with a truck mounted drilling rig; either:

- a Drillmec G55 rig, or equivalent; or
- an Ensign rig.

This REF has assessed the worst-case scenario in terms of noise generation from the drilling rigs. The Drillmec G55 and Ensign rigs have been used for assessment purposes to establish the environmental mitigation for implementation and criteria for compliance during drilling. Alternative similar drilling rigs may be used during drilling activities, however the prescribed mitigation and criteria established within this REF would remain. Further detail regarding the sound power levels of these drilling rigs is provided in Section 5.4.

Associated equipment includes:

- apparatus to raise and lower rods in the bore hole;
- drive gear for rotary drilling;
- wire line equipment for recovery of core tubes and downhole devices such as magnets for recovery of broken bits, if required; and
- pumps for circulation of drilling fluids.

The drilling of the reservoir corehole involves several sections, which are described in the sections below.

2.4.2 Conductor section of reservoir corehole

The conductor casing would be cemented in place to provide a seal and prevent washouts, whilst the surface casing is being drilled. The depth of the casing to be cemented would vary from site to site and is dependent upon the formation encountered, in accordance with standard drilling practice.

2.4.3 Surface hole section of the reservoir corehole

Following drilling of the surface hole section a steel surface casing would be inserted to minimum of 100m and would be pressure cemented back to surface, as per standard industry practice. The purpose of this

casing is to isolate shallow aquifers and other formations that may be encountered during the drilling process. This also provides structural support for the blow out prevention equipment (BOP).

2.4.4 Open hole section

Beyond the steel surface casing the rest of the reservoir corehole is referred to as the open hole section. In the case of PL05 once logged this hole section would be cased and cemented as per good oilfield standard. This ensures that there is no interaction between aquifers or strata and the targeted coal seams, and ensures no cross-contamination between aquifers. Further information on potential groundwater impacts is set out in Section 5.9. The open hole section is drilled to the target depth, in this case either 400 m, 500 m or 800 m depending upon the drilling scenario.

2.4.5 Logging

Once the drilling of the proposed reservoir coreholes has reached the target depth, downhole wireline geophysical logging would be undertaken for the full depth over a period of up to two days at each borehole. The geophysical logging involves the lowering of probes into the proposed reservoir corehole which is specifically designed to record strata characteristics as the probe is slowly raised in the reservoir corehole. One or more of these probes would contain small radioactive sources and only approved licensed operators are authorised to use and transport the devices. The drilling rig would remain on standby during this testing phase.

2.4.6 Permeability testing

Once downhole wireline geophysical logging has been completed, a program of coal seam permeability testing may be conducted over a period of three to five days at the proposed site. The testing procedure involves the lowering of specifically designed 'tools' on slim rods or a wireline into the proposed reservoir corehole. The tools would isolate specific target coal seams to determine permeability characteristics of the coal seam. Only experienced operators are used for this testing. The d rilling rig would remain on standby during this time.

2.4.7 Casing

Should PL05 be drilled, it is proposed to be cased, cemented and suspended as a potential future production well. The casing would be run to the target depth (ie a maximum of 800 m should PL03 or PL05 be drilled) and cemented to the surface.

2.4.8 Drilling fluids and tank storage

The proposed reservoir coreholes will be drilled utilising a fresh water based fluid containing one or a combination of constituents that may include; potassium chloride, potassium sulphate, bentonite clay, polyanionic cellulose, partially hydrolysed polyacrylamide, xanthium gum, acrylic polymer, anionic surfactants and sodium carbonate. Material Data Safety Sheets (MSDS) are provided in Appendix E and further information on potential environmental interactions provided in Appendix F. An alternate drilling fluid medium may also include the use of high pressure air. No petroleum based fluids or additives are used in the drilling of the proposed reservoir coreholes.

These drilling fluids when mixed with fresh water make up the drilling mud used in the drilling process. Drilling mud is used to:

- maintain well control (that is, pressure exerted by the mud on the formation is greater than the pressure within that formation to avoid any reservoir fluids flowing into the reservoir corehole during drilling);
- effectively bring the drill cuttings to the surface to avoid any drilling components becoming stuck if the cuttings build up around the equipment;
- cool and lubricate the drill bit; and
- ensure that the hole maintains integrity throughout the drilling operations and avoid any swelling of any clays within the formations that are being drilled.

Any water based drilling fluids would be contained in a series of tanks located on each construction pad. Air circulation returns would be directed to the tanks via a blooie line. Any drilling fluids containing excessive amounts of polymer or other additives would be removed from the site and disposed of at an appropriate facility. Any water left in the tanks at the completion of drilling would also be disposed of at an appropriate facility. All drilling fluids would be managed within a closed system, preventing any ability for this fluid to leave the site and enter a drainage line or creek.

The water required for the drilling would be obtained from existing water storages in the vicinity of the proposed reservoir coreholes, and transported to the drill site by a local contractor, as follows:

- Scenario 1: PL01 and PL02, proposed target depths of 400 m and 500 m respectively, will require approximately 100,000 litres (L). This would be split across the two reservoir coreholes;
- Scenario 2: PL03, proposed target depth of 800 m, will require approximately 100,000 L.
- Scenario 3: PL05, proposed target depth of 800 m, will require approximately 100,000 L.

Although the sites selected for the proposed reservoir coreholes are relatively flat, precautions for periods of heavy rain would be employed. The following design and mitigation measures will be implemented during the drilling phase of the works:

- lined and bunded area for storage of all oil/lubricant and additives;
- clearly labelled containers/storage;
- MSDS onsite for handling the additives;
- spill kits located throughout the site;
- double skinned tanks for fuel storage;
- additives are blended in a controlled environment into enclosed tanks;
- appropriate location for storage (that is, not near any sensitive areas identified within this REF);
- the shallow surface formations and aquifers are protected during drilling to the coals by rated casing and specifically designed cement; and
- drill fluid volumes are monitored at all times throughout the operations allowing fast reaction times to any fluid loss into any formations that may be observed.

Additionally, an upslope surface water flow would be directed around the site. Sediment traps (ie silt fences) would also be used to prevent soil loss from the site. Further information regarding the drilling fluids is provided in Appendix F.

2.5 Water management

Water from the drilling of the proposed reservoir coreholes would be collected in above-ground storage tanks. The optimal disposal option for the collection of production water would be dependent upon the quality and quantity of water produced, which can only be definitive determined once testing commences. The tanks have been chosen based on the information collected from previous drilling activities in the PEL as well as investigations undertaken as part of the GGP. The tanks are designed to hold a significant amount of water for a number of days.

It is proposed that water contained within the tanks will be transported by truck to be stored in purpose built water storages on Tiedmans which is owned by the proponent. As discussed in Section 1.2, PL01 and PL02 are located on Tiedmans whilst PL03 and PL05 are located on adjacent property. , located near the subject site. This property, commonly referred to as 'Tiedmans' has been previously used for water storage for produced water from other exploration sites in the PEL. In the event that 'Tiedmans' is not able to receive the water, it will be transported to the nearest licensed disposal facility. Further detail regarding the traffic impacts of the disposal of produced water is provided in Section 5.11.

'Tiedmans' is currently zoned RU1 Primary Production. The proposed water storage facilities at 'Tiedmans' have previously been approved by the Minister for Mineral Resources.

2.6 Rehabilitation and future use

At the conclusion of the proposed works, PL01 and PL02, or PL03 would be maintained as VWPs, while PL05 would be cased and suspended as a potential future production well pending further planning and environmental approvals. The final drill site will be rehabilitated to a condition equal to or better than the condition of the area prior to the commencement of works. The rehabilitation activities will be discussed and agreed upon with the landowner prior to commencement of drilling activities.

2.7 Vibrating wire piezometer

As part of the proposed works, up to two VWPs would be installed at the final site(s) depending on intersection of suitable geological conditions. The VWP(s) will be located at any of the reservoir coreholes, depending on the drilling scenario that is selected. The depth of each of the VWPs is yet to be determined but will be opposite targeted coal seams. The VWP(s) would be cemented into place with grout to act as a seal between the coal seams and other formations. The grout would conveyed to the bottom of the well via a poly ethylene tube. Upon the completion of the grouting of the VWP(s) into position a wellhead would be installed upon the surface casing to provide a secondary barrier in the unlikely event that migration may occur along the wire. This wellhead would have pressure gauges fitted to the outlets. The wirese would be conveyed through the wellhead via the use of certified packoffs. The pad upon which the piezometer would be developed is anticipated to be within the pad used for the drilling of the reservoir core hole. The installed logger in the VWP would constantly measure formation pressure. The VWP(s) would be incorporated into the groundwater monitoring network for the GGP and the relevant bore licences obtained from the NSW Office of Water (NOW).

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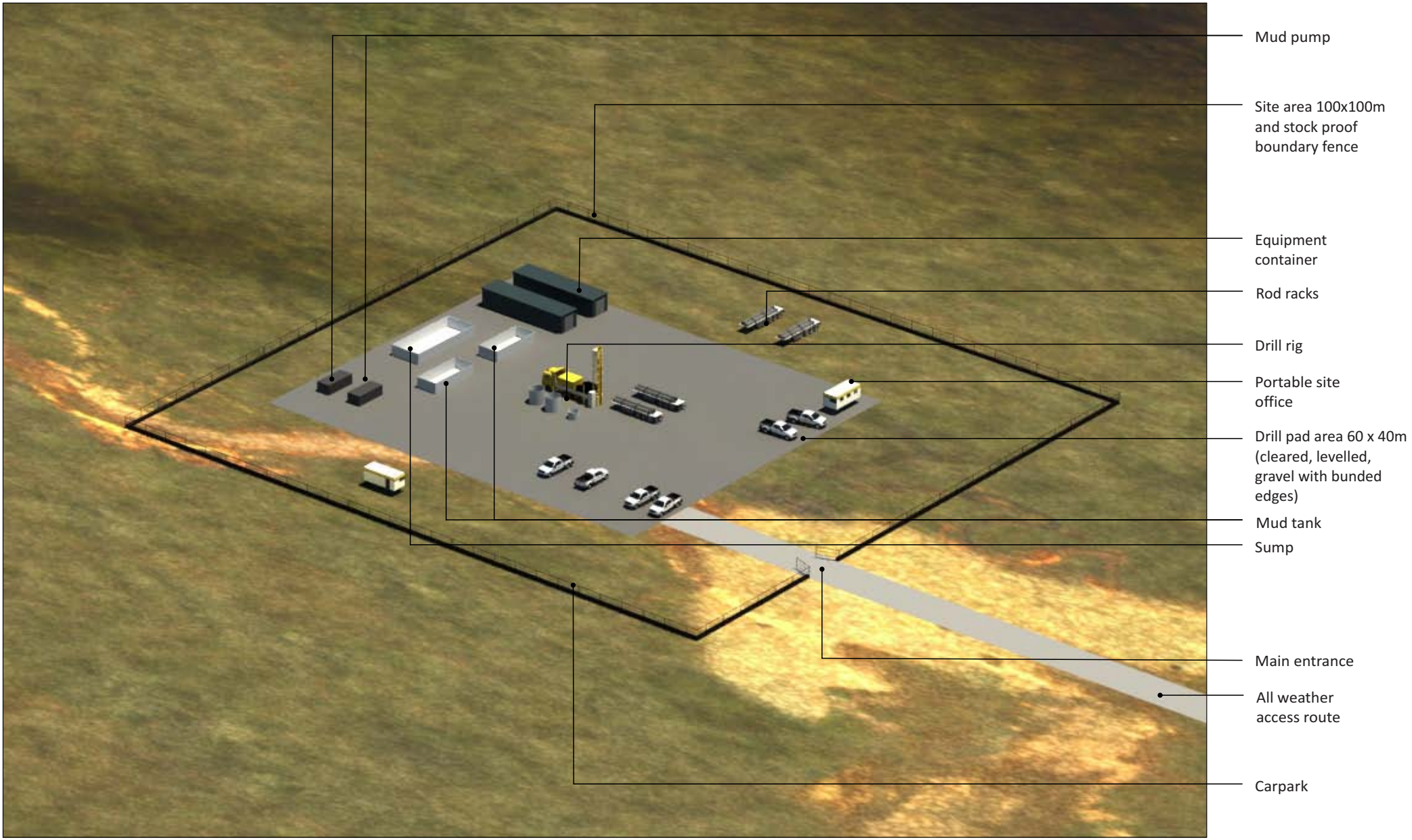

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Indicative drill site layout

Proposed reservoir coreholes – Review of Environmental Factors

FIGURE 2.1

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3 Planning and statutory context

3.1 Petroleum (Onshore) Act 1991

The NSW *Petroleum (Onshore) Act 1991* regulates the search for onshore production and extraction of petroleum (ie oil and gas) in NSW. It creates exploration and production titles and also addresses environmental protection, royalties and compensation. The NSW Petroleum (Onshore) Regulation 2007 requires all exploration or other activity carried out under the authority of a petroleum title to be carried out in conformity with the schedule published by the DTIRIS.

Under this Act the definition of 'petroleum' includes any naturally occurring hydrocarbon, whether in a gaseous, liquid or solid state, but specifically *does not* include coal or oil shale. Methane (the major component of CSG is a gaseous hydrocarbon, and therefore CSG is defined as a petroleum activity under this Act.

Before undertaking any activities, companies or individuals wishing to explore for CSG in NSW must first apply to the Minister for Mineral Resources for a licence issued under the NSW *Petroleum (Onshore) Act*.

There are three main types of permits issued under the NSW *Petroleum (Onshore) Act*:

- PEL;
- Petroleum Assessment Lease (PAL); and
- Petroleum Production Lease (PPL).

As previously stated, AGL has been issued PEL 285 under the provisions of the NSW *Petroleum (Onshore) Act 1991*. To ensure environmental protection, operators apply for permission to operate by submitting an REF to DTIRIS. The REF describes how the operator would manage identified risks relating to the environment.

3.1.1 Petroleum Exploration Licence No 285

The reservoir coreholes would be undertaken in accordance with the provisions of PEL 285, which is held by AGL. Under the provisions of the PEL the proposed reservoir coreholes would be classified as a Category 3 activity under the PEL. Condition 1 of the Second Schedule states that:

> *The type of activity listed in Category 3 requires notification to an Environmental Officer of the Department and will normally require an additional specific determination under Part 5 of the Environmental planning and Assessment Act, 1979. At least 4 weeks prior to the proposed commencement of any activity listed in Category 3, a Review of Environmental factors in accord with Clause 228 of the Environmental Planning and Assessment Regulation 2000 must be submitted to the Department to enable determination under Part 5 of the Environmental Planning and Assessment Act, 1979 to be made.*

3.2 Environmental Planning and Assessment Act 1979 and Environmental Planning and Assessment Regulations 2000

The EP&A Act provides the legislative requirements and processes for any development (infrastructure, residential, industrial etc) in NSW. Any development in NSW is determined in accordance with the

provisions of Part 4 or Part 5 of the EP&A Act. Under the provisions of section 76 of the EP&A Act and the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP), Part 5 of the EP&A Act will apply to the proposed reservoir coreholes as identified in the PEL.

Under section 111 of the EP&A Act, AGL is required to consider the potential environmental impacts of any activity before DTIRIS determine whether or not the activity can proceed. The potential environmental impacts of a proposal are, generally, identified within an REF. Under section 112, if the REF identifies that the proposed activity would have a significant environmental impact then an Environmental Impact Statement (EIS) is required to be prepared.

In addition, clause 228 of the EP&A Regulation identifies a series of 'factors' which must be considered when an REF is being prepared. These factors have been considered in preparing this REF. A summary of the aspects addressed in this REF with reference to clause 228 of the EP&A Regulation is provided in Section 7.3.

3.3 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The aims of this SEPP are:

a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State, and

b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and

c) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources.

Under clause 6 of the Mining SEPP development for any of the following purposes may be carried out without development consent:

a) mineral exploration and fossicking,

b) rehabilitation, by or on behalf of a public authority, of an abandoned mine site,

c) mining within a mineral claims district pursuant to a mineral claim under the NSW *Mining Act 1992*,

d) petroleum exploration,

e) the construction, maintenance or use (in each case, outside an environmentally sensitive area of State significance) of any pollution control works or pollution control equipment required as a result of the variation of a licence under the NSW POEO Act, being a licence that applies to an extractive industry, mine or petroleum production facility in existence immediately before the commencement of this clause.

Although petroleum exploration (ie reservoir corehole drilling) is identified as development which does not require consent, this does not preclude an REF or EIS from being prepared as a result of the provisions

of section 76 of the EP&A Act. Section 76(2) of the EP&A Act notes that, only where an environmental planning identifies a development to be 'exempt' does Part 5 of the EP&A Act not apply. As the proposed reservoir coreholes are *not* identified as 'exempt' then Part 5 of the EP&A Act will still apply.

3.4 State Environmental Planning Policy (Infrastructure) 2007

The aim of this SEPP is to facilitate the effective delivery of infrastructure across NSW. The SEPP is divided into a number of Divisions which allow works on, or on behalf, of a public authority to be carried in relation to electricity, gas, water and sewer, telecommunications, roads, airports, hospitals, railways, educational establishments, correctional centres, and the like. Division 9 applies to gas pipelines which are licensed under the NSW *Pipelines Act 1967* and NSW *Gas Supply Act 1996*, however, this SEPP does not apply to the proposed reservoir coreholes.

3.5 State Environmental Planning Policy No. 55 (Remediation of Land) 1998

The objective of this SEPP is to provide for a statewide planning approach to the remediation of contaminated land. In particular, this SEPP aims to promote the remediation of contaminated land:

a) by specifying when consent is required, and when it is not required, for a remediation work, and

b) by specifying certain considerations that are relevant in rezoning land and in determining development applications in general and development applications for consent to carry out a remediation work in particular, and

c) by requiring that a remediation work meet certain standards and notification requirements.

No contamination has been identified on either of the subject sites. The subject sites have a history of agricultural uses. Some minor earthworks would be required to level the pad upon which the drilling would take place. It is considered that these minor works would not result in any contamination of the land as identified under this SEPP, and that the previous disturbance of the land from agricultural activities is unlikely to have resulted in any significant contamination issue. Therefore, it is considered that a Phase 1 Environmental Site Assessment is not required or warranted for any of the proposed activities.

Nonetheless, if any contaminants are found during any works it would be necessary to have the contamination assessed, remediated and the site validated by a site contamination consultant. The assessment shall be carried out by a recognised contaminated land consultant and in accordance with the Office of Environment and Heritage (OEH) guidelines and the NSW *Contaminated Land Management Act 1997*.

3.6 Protection of the Environment Operations Act 1997

The POEO Act aims to protect and reduce degradation of the environment from development activities. The POEO Act examines issues such as air and water pollution, waste management and noise. The POEO Act also prescribes 'scheduled activities' in which a license must be obtained from the OEH. These 'scheduled activities' include industrial, mining, petroleum and agricultural developments of a certain size. Clause 5 and Schedule 1 of the POEO Act identify works that are considered to be a 'scheduled activity'. For petroleum works this includes activities which:

1. produce, other than in the course of exploratory activities, crude or shale oil, or

2. produce more than 5 PJ per year of natural gas or methane, or

3. refine crude petroleum, shale oil or natural gas, or

4. manufacture more than 100 tonnes per year of petroleum products (including aviation fuel, petrol, kerosene, mineral turpentine, fuel oils, lubricants, wax, bitumen, liquefied gas and the precursors to petrochemicals such as acetylene, ethylene, toluene and xylene), or

5. store petroleum and natural gas products with an intended storage capacity in excess of:

    a) 200 tonnes of liquefied gases, or

    b) 2,000 tonnes of any petroleum products, or

    c) dispose of oil waste or petroleum waste or process or recover more than 20 tonnes of oil waste or petroleum waste per year.

The proposed reservoir coreholes are not identified as a 'scheduled activity' and therefore do not require the proponent to obtain an environment protection licence (EPL) from OEH.

3.7 Threatened Species Conservation Act 1995

The TSC Act aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The objectives of the TSC Act are:

- to conserve biological diversity and promote ecologically sustainable development, and
- to prevent the extinction and promote the recovery of threatened species, populations and ecological communities, and
- to protect the critical habitat of those threatened species, populations and ecological communities that are endangered, and
- to eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities, and
- to ensure that the impact of any action affecting threatened species, populations and ecological communities is properly assessed, and
- to encourage the conservation of threatened species, populations and ecological communities by the adoption of measures involving co-operative management.

In general, the TSC Act provides for the identification, and classification, of threatened species, populations and ecological communities. It also provides for the identification of key threatening processes that are most likely to jeopardise the survival of those species, populations and ecological communities.

The TSC Act also contains provisions about species impact statements. These statements are prepared to measure the significance of the effect of actions on threatened species, populations or ecological communities, or their habitats. A species impact statement must be lodged with an application for a licence under this Act if the Director-General determines that the action proposed is likely to significantly affect threatened species, populations or ecological communities, or their habitats.

If the action proposed to be taken by the applicant is not on land that is critical habitat and the application is not accompanied by a species impact statement, the Director-General must determine whether the action proposed is likely to significantly affect threatened species, populations or ecological communities, or their habitats.

An assessment of the impact on flora and fauna has been prepared for the proposed reservoir coreholes, which is discussed in Section 5. The assessment identifies that the proposed works would have no impact on identified threatened flora or fauna.

3.8 National Parks and Wildlife Act 1974

The objectives of the NPW Act include:

a) the conservation of nature, including, but not limited to, the conservation of:

   i) habitat, ecosystems and ecosystem processes, and

   ii) biological diversity at the community, species and genetic levels, and

   iii) landforms of significance, including geological features and processes, and

   iv) landscapes and natural features of significance including wilderness and wild rivers,

b) the conservation of objects, places or features (including biological diversity) of cultural value within the landscape, including, but not limited to:

   i) places, objects and features of significance to Aboriginal people, and

   ii) places of social value to the people of NSW, and

   iii) places of historic, architectural or scientific significance,

c) fostering public appreciation, understanding and enjoyment of nature and cultural heritage and their conservation,

d) providing for the management of land reserved under this Act in accordance with the management principles applicable for each type of reservation.

In general the NPW Act seeks to conserve areas of significant biological diversity (eg National Parks, Nature reserves etc). Under the NPW Act it is an offence to harm threatened species or endangered ecological communities. In addition, the NPW Act also protects Aboriginal areas and items. It is also an offence under the NPW Act to disturb or destroy an Aboriginal object, without the consent of the Director-General.

In relation to the proposed reservoir coreholes, an assessment of flora and fauna has been prepared which identifies that no threatened species or endangered ecological communities would be disturbed by the proposed works, if the recommendations of the REF are implemented (Section 5). As assessment of the impact of the proposed activities on Aboriginal cultural heritage was also prepared which concluded that the works are highly unlikely to disturb any items or areas of Aboriginal significance (Section 5). In the unlikely event that any items are identified during the work, the work must immediately cease in the vicinity of the item, and the OEH should be notified.

3.9 Heritage Act 1977

The NSW *Heritage Act 1977* aims to maintain items and areas of European heritage significance. The objectives of the Heritage Act are:

a) to promote an understanding of the State's heritage,

b) to encourage the conservation of the State's heritage,

c) to provide for the identification and registration of items of State heritage significance,

d) to provide for the interim protection of items of State heritage significance,

e) to encourage the adaptive reuse of items of State heritage significance,

f) to constitute the Heritage Council of NSW and confer on it functions relating to the State's heritage,

g) to assist owners with the conservation of items of State heritage significance.

Under the Heritage Act a register must be maintained of all heritage items and areas of state significance. This register is called the State Heritage Register (SHR) and is administered by the Heritage Council.

Under the Heritage Act (ie section 139) it is an offence to disturb or excavate land that will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed unless an appropriate permit has been approved. A search of relevant heritage databases revealed that the works would not impact on any items or areas of heritage significance.

3.10 Water Management Act 2000 and Water Act 1912

The NSW *Water Management Act 2000* (WM Act) provides for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations and, in particular:

a) to apply the principles of ecologically sustainable development, and

b) to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality, and

c) to recognise and foster the significant social and economic benefits to the State that result from the sustainable and efficient use of water, including:

   i) benefits to the environment, and

   ii) benefits to urban communities, agriculture, fisheries, industry and recreation, and

   iii) benefits to culture and heritage, and

   iv) benefits to the Aboriginal people in relation to their spiritual, social, customary and economic use of land and water,

d) to recognise the role of the community, as a partner with government, in resolving issues relating to the management of water sources,

e) to provide for the orderly, efficient and equitable sharing of water from water sources,

f) to integrate the management of water sources with the management of other aspects of the environment, including the land, its soil, its native vegetation and its native fauna,

g) to encourage the sharing of responsibility for the sustainable and efficient use of water between the Government and water users,

h) to encourage best practice in the management and use of water.

The WM Act sets out principles for the management of water in NSW. The principles include:

a) water sources, floodplains and dependent ecosystems (including groundwater and wetlands) should be protected and restored and, where possible, land should not be degraded, and

b) habitats, animals and plants that benefit from water or are potentially affected by managed activities should be protected and (in the case of habitats) restored, and

c) the water quality of all water sources should be protected and, wherever possible, enhanced, and

d) the cumulative impacts of water management licences and approvals and other activities on water sources and their dependent ecosystems, should be considered and minimised, and

e) geographical and other features of indigenous significance should be protected, and

f) geographical and other features of major cultural, heritage or spiritual significance should be protected, and

g) the social and economic benefits to the community should be maximised, and

h) the principles of adaptive management should be applied, which should be responsive to monitoring and improvements in understanding of ecological water requirements.

The WM Act applies to those areas in NSW which are subject to Water Sharing Plans. Those areas not covered by a Water Sharing Plan are managed in accordance with the NSW *Water Act 1912.* There is no porous rock Water Sharing Plan in place for the Gloucester Basin at this time.

It is an offence under the WM Act to take water from a water source or interfere with an aquifer without an appropriate licence issued by the relevant authority. Even when a project is being undertaken by a local council or State agency requires an approval or licence is required under the NSW *Water Act 1912* or the WM Act. The proposed reservoir coreholes would intercept deep groundwater on the subject sites (see Section 5). As such, appropriate bore licences (test/monitoring bore) would need to be obtained from NOW prior to exploration activities under the NSW *Water Act 1912*.

The work does not fit the definition of an Aquifer Inference Activity and hence a separate approval is not required in this instance.

It should be noted that there are no streams or rivers that would be directly impacted by the proposed works. Nonetheless, an appropriate water management plan would be prepared for the proposed works

to ensure no impacts would occur on downstream waterways. In addition, during the works appropriate erosion management controls would also need to be in place to ensure the protection of the local rivers and streams. Proposed erosion management measures are described in Section 5.2.3.

3.11 Environmental Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Commonwealth Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the Act as matters of national environmental significance (NES). The EPBC Act focuses Commonwealth Government interests on the protection of matters of NES, with the states and territories having responsibility for matters of state and local significance. The objectives of the EPBC Act are to:

- provide for the protection of the environment, especially matters of NES;
- conserve Australian biodiversity;
- provide a streamlined national environmental assessment and approvals process;
- enhance the protection and management of important natural and cultural places;
- control the international movement of plants and animals (wildlife), wildlife specimens and products made or derived from wildlife; and
- promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources.

In general, the EPBC Act lists flora and fauna, ecological communities, and heritage items and places that are deemed to be of national significance. The eight matters of NES to which the EPBC Act applies are:

- world heritage sites;
- national heritage places;
- wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed);
- nationally threatened species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park; and
- nuclear actions.

These matters of NES are assessed as part of the flora and fauna and heritage assessments. Matters identified on a site that are listed under the EPBC Act mean that the Commonwealth Government's Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) need to concur that the proposed development would not significantly impact upon matters identified as being of national significance. That is, any proposed action that could have a significant impact on a matter of NES

will need to be referred to the DSEWPC for approval before the development can proceed. This approval is in addition to any State or local approval.

In relation to the proposed reservoir corehole activities and subsequent VWP(s), no matters of NES were identified in the heritage review, preliminary Aboriginal cultural heritage assessment or flora and fauna assessment. As such, the proposed development does not need a separate approval under the EPBC Act.

3.12 Native Title Act 1993

The Commonwealth *Native Title Act 1993* provides for the recognition and protection of native title. A search of the National Native Title Tribunal website identified that there are no known native title claims over the land within the areas proposed for works.

3.13 Ecologically sustainable development

Legislation in NSW is consistent with the principles of ecologically sustainable development (ESD). The most common definition of ESD emerged from the 1987 Brundtland Report, introduced by the World Commission on Environment and Development (WCED). The WCED define ESD as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'.

In NSW, Section 6(2) of the *Protection of the Environment Administration Act 1991* (POEA Act) notes that ecologically sustainable development requires the effective integration of economic and environmental considerations in decision-making processes. The Act goes on to note that ecologically sustainable development can be achieved through the implementation of the following principles and programs:

a) the precautionary principle—namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

   in the application of the precautionary principle, public and private decisions should be guided by:

   i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

   ii) an assessment of the risk-weighted consequences of various options,

b) inter-generational equity—namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

c) conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

d) improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services, such as:

   i) polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

Schedule 2 of the EP&A Regulations also identifies that consideration should be afforded to ESD in preparing environmental impact statements. The principles of ESD have been considered in the preparation of this REF. The principles would also need to be considered during the operational phase of the project.

3.14 Other legislation and guidelines

Other legislation was considered in the preparation of this REF, but was identified as not applying to the proposed reservoir coreholes. This includes the *Fisheries Management Act 1994, Coastal Protection Act 1979, Forestry Act 1916* and the *Wilderness Act 1987*.

Other guidelines were considered in preparing this REF. This includes:

- Department of Infrastructure, Planning and Natural Resources (2004) Locational Guidelines: Development in the Vicinity of Operating Coal Seam Methane Wells;
- Mineral Resources NSW (1997) Borehole Sealing Requirements on Land; and
- Department of Primary Industries (2006) Guidelines for Review of Environmental Factors.

3.15 Environmental licences and permits

The table below identifies a number of pieces of State and Commonwealth legislation and whether a permit is required under that Act or Regulation for the proposed development. The table below excludes any requirements under the EP&A Act, or EP&A Regulation.

Table 3.1 Licence and permit requirements

Relevant legislation where a permit may be required	Permit/Concurrence required
Coastal Protection Act 1979 and Regulation 2004	No
Protection of the Environment Operations Act 1997	No
Water Act 1912	Licence(s) will be required for the proposed reservoir coreholes and subsequent VWP(s) prior to the commencement of works as the reservoir coreholes would intercept groundwater
Threatened Species Conservation Act 1995	No
Fisheries Management Act 1994	No
National Parks and Wildlife Act 1974	No
Forestry Act 1916	No
Wilderness Act 1987	No
Heritage Act 1977	No
Native Vegetation Act 2003	No
Roads Act 1993	No
Commonwealth Environmental Protection and Biodiversity Conservation Act 1999	No
Commonwealth Native Title Act 1993	No

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4 Stakeholder and community consultation

4.1 Background

Stakeholder consultation has been undertaken by the proponent for the purposes of this REF. The proposed reservoir coreholes PL01 and PL02 are located on land, known as 'Tiedmans', owned by the proponent. The private landholder (PL03 and PL05) directly affected by the proposal has been consulted, and access arrangements have been negotiated. Additional consultation with this landholder will be undertaken prior to the commencement of any works. Nearby neighbours to the proposed activity will be consulted in person and information sheets on the proposed reservoir coreholes will be prepared and distributed.

The proponent continues to maintain an open and ongoing communication with the local community about its present and future projects. Communications with the public are maintained through AGL's GGP website, as well as the GGP Community Consultative Committee (CCC).

Extensive community consultation for the Part 3A environmental assessment of the GGP began in February 2008 to ensure community views were captured, and incorporated into the environmental assessment recently approved by the NSW PAC. A variety of consultation techniques were implemented, and continue to be designed to enable information about the GGP to effectively reach target audiences.

The overall objective of community consultation for the GGP is to ensure clear, effective, open, two-way communication at all times by listening, recording and responding to issues. The approach so far has included distributing information to and interacting with the local community and landowners affected by the proposed development, and to obtain community feedback.

4.2 Community consultative committee

As part of the wider GGP a CCC was formed in September 2008 to provide a forum for discussion and exchange of information between the community, Government agencies and AGL. The CCC assists AGL in identifying project related local issues for consideration during the development, environmental, construction and operational phases of the any project within the GGP. It also acts as a communication link between AGL, the community and other stakeholders.

The CCC includes representatives from the community, local Landcare Group, environment groups, Gloucester, Great Lakes, Dungog and Port Stephens Council's, as well as representatives from AGL. Minutes from the CCC meetings are also available to individuals on the GGP web site. The proposed reservoir coreholes were discussed at the CCC meeting in October 2011. The CCC will continue to be consulted regarding the proposed activities prior to commencement of the activities.

4.3 Consultation with government organisations

During the preparation of the REF, DTIRIS was consulted with respect to the content requirements, including information on the proposed drilling fluids. This REF has been prepared in accordance with those requirements and clause 228 of the EP&A Regulation (refer to Section 7 of this REF). Additionally, Gloucester Shire Council will be consulted regarding the proposed reservoir coreholes prior to commencement of the drilling activities.

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5 Environmental interactions

5.1 Introduction

This REF has investigated the potential environmental interactions with the proposed activity, described in Section 2. This section outlines and describes the existing environment, potential impacts and mitigation measures to be implemented during the proposed activities.

5.1.1 Proposed location of PL01

PL01 is located in an open paddock, 50 m north of Dog Trap Creek on the 'Tiedmans' property, shown in Photograph 5.1 below. This proposed drilling site will be accessed from internal roads within 'Tiedmans', from Fairbairns Road and Tiedmans Lane. PL01 is located adjacent to a previously drilled exploration well, known as Stratford 8.

Photograph 5.1 Proposed location of PL01

5.1.2 Proposed location of PL02

PL02 is located in an area of remnant native vegetation on 'Tiedmans', and will be accessed by internal roads within the property. The proposed drilling site is located across an area that is largely clear of vegetation shown in the foreground of Photograph 5.2 below. The drill site will require minimal vegetation removal prior to works, discussed further is Section 5.5.2ii.

Photograph 5.2 Proposed location of PL02

5.1.3 Proposed location of PL03

PL03 is located in an open paddock, as shown in Photograph 5.3 below. Access to PL03 will require the construction of a temporary access track from Tiedmans Lane, which is shown in Figure 1.2.

Photograph 5.3 Proposed location of PL03

5.1.4 Proposed location of PL05

PL05 is located in an open paddock, as shown in Photograph 5.4 below. Access to PL05 will require the construction of a temporary access track from Tiedmans Lane, which is shown in Figure 1.2.

Photograph 5.4 Proposed location of PL05

5.2 Geology and soils

5.2.1 Existing environment

The Gloucester geological basin straddles the Manning River Catchment to the north and the Karuah River Catchment to the south. The subject sites are within the Manning River Catchment which is approximately 8,200 km^2 in size. The subject sites are within the Avon River Sub-Catchment. The Avon River originates to the south west of Gloucester and joins the Gloucester River to the north of the township of Gloucester. Waukivory Creek, Dog Trap Creek and Avondale Creek are also located within the sub-catchment.

The landforms of the locality are guided by the geology of the Stroud-Gloucester Syncline and comprise ridges to the east and west, undulating low hills and flat land in the centre where the Avon River flows to the north. The lowest points in the area are on the Avon Rover floodplain at approximately 100 m RL.

The Gloucester Geological Basin is a synclinal structure formed by Permian consolidated sediments. The Permian Rocks display steep dips of up to 90° on the edge of the basin, dipping towards the north-south axis, and flattening towards the basin centre. They lay on a basement composed of Early and Late Carboniferous sedimentary and volcanic units that are part of the New England Fold Belt. The geology of the area comprises Quaternary sediments along the valley floor and Permian rocks along the flanks and over most of the catchment. Carboniferous volcanics form the major east and west ridgelines.

A summary of the stratigraphy of the area is presented in Table 5.1.

Table 5.1 Summary of relevant stratigraphy

Group	Sub-Group	Formation	Approx Thickness (m)	Coal Seams
Gloucester Coal Measures	Craven Sub-Group	Crowthers Road Conglomerate	350	
		Leloma Formation or Woods Road	585	Linden Marker M6, M7 ("JD Coals") Bindaboo Deards
		Jilleon Formation or Bucketts Way	175	Cloverdale Roseville Marker M3, M8, M1 ("Tereel Coals" – Fairbarins Road)
		Wards River Conglomerate	Varies	-
		Wenham Formation	24	Bowens Road (BR0 – BR5) Bowens Road Lower (BR6)
	Speldon Formation		77	
	Avon Sub-Group	Dog Trap Creek Formation	126	Glenview Marker M2
		Waukivory Creek Formation	326	Avon Triple Rombo Glen Road Valley View Parkers Road
Dewrang Group	Mammy Johnsons Formation		300	Mammy Johnsons
	Weismantel Formation		20	Weismantel
	Duralie Road Formation		250	
Unconformity				
Alum Mountain Volcanics				Clareval Basal Coal Seam

Source: AECOM (2009) Gloucester Gas Project Environmental Assessment, prepared for AGL.

5.2.2 Potential impacts

Drilling activities that necessitate the removal of vegetation and disturbance to the soil surface have the potential to lead to some erosion and sedimentation impacts. Control of soil erosion requires appropriate management to avoid the reduction of surface water quality through erosion processes and subsequent sedimentation. The use of heavy equipment and other vehicles during drilling and rehabilitation of the drill site also has the potential to result in compaction of soils.

The locations of the proposed drilling activities require only minimal surface disturbance and limited removal of vegetation. PL01, PL03 and PL05 are located on extensively cleared pastoral land, and would require the removal of grass for the drill pad and access route. PL02 is located within an area of remnant vegetation, and would require limited, if any, vegetation removal. Access to PL02 is by an existing, well-maintained vehicle track. The drill rig would utilise this track as much as possible to minimise any disturbance to vegetation. As disturbance at the proposed drill sites would be limited, and given the measures outlined below, it is unlikely that the proposed activities will contribute to erosion and sedimentation processes which would impact the receiving environment.

5.2.3 Mitigation measures

The following environmental management measures will be implemented during the proposed works to reduce the occurrence and extent of soil erosion, and maintain soil stability:

- existing roads and tracks shall be used where practicable;
- all vehicles shall remain on the drill site area and designated access routes;
- sedimentation control fences, hay bales, or turf strips will be installed at areas susceptible to erosion; and
- at the conclusion of the proposed works the compacted gravel at the hard-stand will be removed from the proposed site in trucks.
- compacted areas shall be ripped or scarified to facilitate plant growth;

5.3 Climate

The regional climate is characterised by hot summers, averaging 27°C in January, with periods of humid, stormy conditions, while winters are cool to mild and dry with average temperatures of 6°C in July.

Meteorological data is collected at the Gloucester Post Office station, approximately 8.5 km north of the proposed reservoir coreholes. The average annual rainfall in the area is 950 mm per annum, while the average evaporation rate is 1,103 mm. Evaporation exceeds precipitation from August to January.

5.4 Noise and vibration

5.4.1 Introduction

A noise assessment for conducted by EMM for the proposed reservoir coreholes and is provided in Appendix C. The assessment considered:

- the construction noise impact from the drilling of the reservoir coreholes; and
- potential management and mitigation strategies for the proposed works.

The construction component of the proposed activity will include site preparation, establishment and drilling of the reservoir corehole. The operational component will involve maintaining VWPs, or in the case of PL05, the reservoir corehole being capped and suspended, pending future approval for production. As the noise generated by the operational activities will be relatively low in comparison to construction activities, this has not been considered in the assessment.

5.4.2 Construction noise assessment criteria

The OEH Interim Construction Noise Guidelines (ICNG) provides guidelines for the assessment and management of noise from construction works.

The ICNG provides two methodologies for the assessment of construction noise emissions:

- quantitative, which is suited to major construction projects with typical durations of more than three weeks; and
- qualitative, which is suited to short term infrastructure maintenance (less than three weeks).

Whilst it is expected that the proposed construction period will be undertaken in less than three weeks, site conditions could result in a slightly longer drilling period in excess of the expected three weeks. As previously stated, activities are expected to occur during day and night time periods. The quantitative assessment methodology, which includes noise emission predictions from construction activities to the nearest sensitive receivers, is the most suitable for the proposed activities.

In addition, the OEH suggests the following time restriction for the construction activities where noise is audible at residential premises:

- Monday to Friday 7:00 am to 6:00 pm;
- Saturday 8:00 am to 1:00 pm; and
- no construction work is to take place on Sundays or public holidays.

Table 5.2 is an extract from the ICNG and provides noise management levels for residential receivers for daytime and out of hours periods. These time restrictions are the primary management tool of the ICNG.

Table 5.2 ICNG residential criteria

Time of Day	Management Level $L_{Aeq\ (15\ min)}$*	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 db(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: i) times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences). ii) If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements, see Section 7.2.2.

Source: Interim Construction Noise Guidelines (OEH)

In summary, the ICNG noise level goals for activities during the standard hours are 10 dB above the existing background levels. For activities outside of the above hours the noise levels should be no more than 5 dB above the existing background levels.

A 'short-term' background noise assessment was undertaken during the daytime on 28 June 2011 in the general vicinity of PL01 resulting in an $L_{90,15minute}$ of 32 dB(A). Therefore, as there is no other substantial existing background noise data at the surrounding sensitive residences, this assessment adopted a conservative approach of setting a background noise level of 30 dB(A), typical of rural environments. This approach is consistent with the guidelines of OEH's Industrial Noise Policy (INP). The residential construction noise criteria for the proposal are provided in Table 5.3.

Table 5.3 Residential construction noise criteria

Location	$L_{Aeq, 15min}$ Noise Criterion, dB(A)
Residential Assessment Locations	40, ie background plus 10 dB (recommended hours)
	35, ie background plus 5 dB (out of hours)

5.4.3 Sleep disturbance criteria

The criteria outlined in the previous section consider the average noise emission of a source over a specified time. However, on-site sources such as truck reversing alarms and hand tool clangs are intermittent (rather than continuous) in nature, and as such, need to be assessed using L_1 or L_{max} noise metrics.

The most important impact of such intermittent noises would be to disturb the sleep of nearby residents during the OEH defined night period of 10:00 pm to 7:00 am.

The OEH's current position on sleep disturbance is that L_1 or L_{max} noise from a source should not exceed the existing background noise level by more than 15 dB and hence the proposed night time criterion for the adopted representative location becomes:

- 45 dB(A)L_{max}, for intermittent type events from the reservoir corehole site alone.

For the purposes of the assessment, the descriptors L_1 and L_{max} are considered interchangeable.

5.4.4 Predicted noise levels and impact assessment

Prediction of noise from construction associated with the proposed reservoir coreholes was undertaken using mathematical calculations based on existing data.

i Noise assessment locations

The closest and potentially most exposed noise sensitive receivers to the proposed reservoir corehole sites are shown in Figure 5.1 and Table 5.4.

Table 5.4 Noise assessment locations

Location (refer to Figure 5.1)	Nearest distance to reservoir corehole works (m)
1	470 (to PL03)/ 366 (to PL05)
2	1,800 (to PL01)
3	1,315 (to PL02)

Nearby receivers

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ii Construction noise levels

Drilling activities are expected to occur for up to twenty working days, and will be undertaken day and night due to local geology, reservoir corehole conditions and integrity, and for safe operations. Only drilling activities have been assessed in detail as they represent the noisiest construction activities.

A summary of calculated worst case noise levels for drilling and reservoir corehole construction activities for the nearest residential location to each drilling location are provided in Table 5.5 below.

Table 5.5 Worst case construction noise levels for drilling reservoir coreholes, dB(A)

Location (Figure 5.1 Ref.)	Ensign Rig		Drillmec G55		L_{eq} *Noise Level Criteria, dB(A)*		
	Overall	Optimised	Overall	Optimised	*Standard hours*	*Out of hours*	*Highly noise affected*
1	43	38	47	40			
2	26	21	30	23	*40*	*35*	*75*
3	29	24	33	26			

Predicted noise levels using the Ensign, or Drillmec or equivalent rig is expected to satisfy all criteria at locations 2 and 3. For location 1, noise levels comply with the standard and highly noise affected criteria and exceed the out of hours criteria by up to 3 dB using the sound power levels of the Ensign rig and 5 dB using the sound power levels of the Drillmec or equivalent rig for the drilling of either PL03 or PL05.

Therefore, it is recommended that for drilling operations occurring during standard hours at PL03 or PL05 that the selected drilling rig be orientated with the rear of the unit facing the residence (location 1) to negate the exceedences and ensure daytime criteria is achieved.

iii Sleep disturbance noise predictions

A typical source sound power (emission) level of 115 dB(A) was used to predict L_{max} at receivers. L_{max} noise levels assessed against the sleep disturbance criterion (45 dB(A)) in presented in Table 5.6 below.

Table 5.6 Predicted L_{max} noise levels, dB(A)

Activity	Locations	Lmax noise emission, dB(A)	Lmax Sleep Disturbance Criterion, dB(A)
Reservoir corehole construction (No Barriers)	1	55	45
	2	42	45
	3	44	45

When working out of hours at either PL03 or PL05, noise emitted from possible intermittent activities should be controlled and managed using the mitigation measures detailed in the following section, which would satisfy the criterion.

5.4.5 Mitigation measures

The following management and mitigation measures were identified in the assessment to reduce emissions:

- orientate the drill rig to take advantage of directional noise characteristics for the closest residence for the given reservoir corehole site;
- ensure the community is consulted and provide them with written notice well in advance of proposed activities;
- where possible obtain a drill rig with lower noise emission levels; and
- employ all reasonable and feasible work practices to minimise any impacts.

i Construction works at PL03 and PL05

During drilling operations at PL03 and PL05, the following mitigation strategies to manage noise are recommended:

- where possible, drilling machinery will be located / orientated to direct noise away from the closest sensitive receivers;
- undertake regular maintenance of drilling machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers;
- the quietest suitable machinery reasonably available will be selected for each work activity;
- the offset distance between noisy items of plant/machinery and nearby sensitive receivers will be maximised;
- where practicable, ensure those noisy plant/machinery are not working simultaneously in close proximity to sensitive receivers; and
- the use of mobile screens or barriers will be adopted for drilling during out of hours periods when working at PL03 and PL05.

5.5 Ecology

5.5.1 Introduction

An ecological assessment of the proposed reservoir coreholes was prepared in accordance with the EP&A Act, TSC Act and EPBC Act. In particular the ecological assessment identified:

- the potential for endangered ecological communities, threatened species and/or their habitat listed under the TSC Act to occur within the area identified for the survey;
- the potential presence of any matters of NES listed under the EPBC Act; and
- the significance of any impacts resulting from the proposed reservoir coreholes.

In order to identify these, the ecological assessment included:

- a review of available literature and ecological databases;
- a site visit to ground-truth the desktop review;

- an assessment to determine the likely impacts of the works, particularly endangered ecological communities, threatened species and/or their habitat or matters of NES; and
- preparation of recommendations to mitigate any potential impacts.

5.5.2 Existing environment

The proposed reservoir corehole sites occur within an agriculture-dominated landscape. Large conservation and woodland areas occur associated with the Avon River State Forest, Running Creek Nature Reserve, Barrington Tops National Park and The Glen Nature Reserve. The site is within the Hunter/Central Rivers Catchment Management Area (CMA) within the Avon River catchment. The proposed reservoir coreholes are mainly located in areas which have been cleared of native vegetation for grazing, or within isolated remnant patches of bushland. An overview of the ecological values of each of the proposed reservoir corehole sites, known as the study area, is provided below.

i Reservoir corehole PL01

The proposed reservoir corehole is within a cleared agricultural paddock. It has been pasture-improved and contains a number of common agricultural weeds. The site is dominated by Kikuyu (*Pennisetum clandestinum*), Lesser quaking grass (*Briza minor*) and White clover (*Trifolium repens*) with patches of Paspalum (*Paspalum dilantum*), Basket grass (*Oplismenus aemulus*) and Couche (*Cynodon dactylon*). In lower lying areas *Juncas continuus* occurs with common weeds including Catsear (*Hypochoeris radicata*) and Fireweed (*Senecio madagascariensis*). A large dead stag occurs at the southern end of the proposed corehole pad site. This will not be removed for the drilling activities.

The site provides limited foraging habitat for common agricultural species such as the Magpie (*Gymnorhina tibicen*) and Welcome swallow (*Hirundo neoxena*). The introduced European rabbit (*Oryctolagus ciniculus*) was also recorded near this site during recent surveys. This site provides limited, if any, habitat for threatened species, populations or communities. Nearby dams provide habitat for migratory bird species such as the Cattle egret (*Ardea ibis*) and aquatic birds such as the Pelican (*Pelicanus conspicillatus*) which were recorded during the recent survey.

ii Reservoir corehole PL02

The remnant vegetation in this area forms a tall open forest dominated by Thin-leaved stringybark (*Eucalyptus eugenoides*) with occasional Thick-leaved mahogany (*Euclayptus carnea*) and spotted gum (*Corymbia maculata*) to the western side of the remnant. The occasional tall shrub occurs throughout the remnant of either Tantoon (*Leptospermum polygalifolium*) or Cherry ballarat (*Expcarpus cumpressiformis*). The low understorey is diverse with a number of herbs, forbs and small shrubs including *Goodenia heterophylla*, Whiteroot (*Pratia purpurascens*), Boxthorn (*Bursaria spinosa*), Rock fern (*Cheilanthes sieberi*), Hairy bush-pea (*Pultenaea villosa*) and Dogwood (*Ozothamnus diosmifolius*) as well as the climbers Purple coral-pea (*Hardenbergia violacae*), Curly wig (C*austic flexuosa*) and Dusky coral-pea (*Kennedia rubicunda*). Blady grass (*Imperata cyclindrica*) and Many-flowered mat-rush (*Lomandra multiflora*) are the main grasses. This community does not meet the description of any endangered ecological communities listed under the TSC Act of EPBC Act.

This area provides potential habitat for a number of threatened species known to occur within the region. This includes potential habitat for the Grey-crowned babbler (*Pomatostomus temporalis*) which was recorded nearby in Tiedmans Lane. It is possible that this remnant also provides potentially suitable habitat for other threatened bird species such as the Varied sittella (*Daphoenositta chrysoptera*), Scarlet robin (*Petroica boodang*) and Speckled warbler (*Pyrrholaemus saggitatus*). It is considered that this area is too isolated and fragmented from other larger remnants for less mobile threatened species to occur.

The area proposed for reservoir corehole site PL02 occurs adjacent a well-maintained access road in an area that has been previously cleared. The proposed work will require minimal, if any, clearing of remnant trees. In this area the dominant trees are Thin-leaved stringybarks and the understorey, while diverse, is not as dense as other less disturbed areas away from the road.

iii Reservoir corehole PL03

As with PL01, the site is within an agricultural paddock that has been pasture improved. The paddock is dominated by Kikuyu, White clover and Couche. In lower lying areas *Juncas continuus* occurs. A number of weeds occur within the pad site including Fireweed, Whisky grass (*Andropogon virginicus*), and Purple-top (*Verbena spp*.).

The site provides limited foraging habitat for common agricultural species. The introduced European rabbit was also recorded near this site during recent surveys, with a fresh borrow located within the roots of a nearby tree. This site provides limited, if any, habitat for threatened species, populations or communities.

iv Reservoir corehole PL05

The proposed PL05 is adjacent to PL03. As such, the vegetation and potential habitat provided by the proposed pad site for PL05 is akin to that described above for PL03 (ie that it provides limited habitat for threatened species, populations or communities). However, of note to both these locations, the paddock is bound by Tiedmans Lane to the east where a known population of the threatened Grey-crowned babbler (*Pomatostomus temporalis temporalis*) has been recorded. The proposed access from this unsealed road occurs adjacent to an identified babbler nest. No babblers were recorded within the vicinity during the site visit. In addition, the access for pad construction and drilling will not result in any direct impact on this nest.

5.5.3 Threatened and migratory species, populations and communities

i Threatened species

A search of the NSW Wildlife Atlas identified one flora species and six fauna species listed under the TSC Act within 5 km of the proposed coreholes. In addition, a search of the EPBC Protected Matters Search Tool identified the potential for a number of species listed as matters of NES to occur within the study area. An assessment of the potential for the study area to provide suitable habitat for such threatened species was undertaken and is included as Table 5.7.

A local population of the Grey-crowned babbler occurs within the study area and there is potentially suitable habitat present for the Speckled warbler within the woodland remnants within the study area, though the latter species is not considered likely to occur (see Appendix A). It is likely that the proposed works could result in temporary disturbance to the Grey-crowned babbler as a result of work crew and plant movements, noise from drilling and other indirect impacts. However, any such impact will be temporary and no habitat areas for these species would be directly impacted.

An assessment of significance has been prepared for the Grey-crowned babbler, presented in Appendix B, which concludes that the proposed works are unlikely to have a significant impact. Therefore, a Species Impact Statement is not required.

Table 5.7 Threatened species habitat assessment for species recorded within 5 km

Species	TSC Act status	EPBC Act status	Distribution and habitat requirements	Potential for occurrence
Trailing woodruff *Asperula asthenes*	V	V	This small herb occurs only in NSW. It is found in scattered locations from Bulahdelah north to near Kempsey, with several records from the Port Stephens/Wallis Lakes area. Found in damp sites often along river banks (OEH 2011).	Low. The proposed reservoir corehole sites and access to the sites do not traverse any areas where suitable habitat for this species occurs.
Speckled warbler *Pyrrholaemus saggitatus*	V	-	Distribution is from south-eastern Queensland, through central and eastern NSW to Victoria (NSW Scientific Committee 2001c). Speckled Warblers occupy Eucalypt and Cypress woodlands on the slopes west of the Great Dividing Range, with an extension of range into the Cypress woodlands of the northern Riverina. Populations also occur in drier coastal areas such as the Cumberland Plain, Western Sydney and the Hunter and Snowy River valleys. Speckled warblers inhabit woodlands with a grassy understorey, often on ridges or gullies. They forage on the ground and in the understorey for arthropods and seeds (Ford et al 1986), in areas with a combination of open grassy patches, leaf litter and shrub cover.	Moderate. The remnant vegetation surrounding PL02 provides potential habitat for this species. However this species has not been recorded within the locality previously and was not recorded during recent surveys. No further assessment is required.
Glossy black-cockatoo *Calyptorhynchus lathami*	V	-	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1,000 m in which stands of she-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur. Feeds almost exclusively on the seeds of several species of she-oak shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites. One or two eggs are laid between March and August (EOH 2011).	Low. The proposed reservoir corehole sites do not contain any significant habitat resources for the glossy black-cockatoo.
Black-necked stork *Ephippiorhynchus asiaticus*	E	-	Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal	Low. No freshwater wetlands occur within the study area. Some small dams and creeks occur however these are not considered likely to provide suitable

Table 5.7 Threatened species habitat assessment for species recorded within 5 km

Species	TSC Act status	EPBC Act status	Distribution and habitat requirements	Potential for occurrence
			shorelines, mangrove margins and estuaries. Breeds in late summer in the north, and early summer further south. A large nest, up to 2 m in diameter, is made in a live or dead tree, in or near a freshwater swamp.	habitat for this species. A small drainage depression occurs 50m to the north of proposed boreholes PL03 and PL05 (outside of the proposed reservoir corehole impact area) which could provide limited potential habitat for this species, though its occurrence would be transient and temporary in this non-permanent water source.
Grey-crowned babbler *Pomatostomus temporalis temporalis*	V	-	Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Flight is laborious so birds prefer to hop to the top of a tree and glide down to the next one. Birds are generally unable to cross large open areas. Feeds on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses. Build and maintain several conspicuous, dome-shaped stick nests about the size of a football. A nest is used as a dormitory for roosting each night. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. Nests are maintained year round, and old nests are often dismantled to build new ones. Breed between July and February.	High. A population of this species is known to occur within the study area. An assessment of significance is required for this species.
Powerful Owl *Ninox strenua*	V	-	Powerful owls are found close to riparian or rainforest vegetation, in areas of either wet or dry sclerophyll woodland, forest or tall open forest (Greenyer 1999). Distributed from south-eastern South Australia to the Dawson Rover in Queensland, common along coastal hills and in low densities along the Great Dividing Range. Associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes (Environment Australia 2000, Debus & Chafer 1994). Large trees with hollows at least 0.5m deep are required for shelter and breeding (Environment Australia 2000).	Moderate. The remnant vegetation within the study area provides potential foraging habitat for this species. However few large hollows occur providing suitable nesting sites for this species and no rainforest gullies suitable for roosting habitat occur.

Table 5.7 Threatened species habitat assessment for species recorded within 5 km

Species	TSC Act status	EPBC Act status	Distribution and habitat requirements	Potential for occurrence
Spotted-tail quoll *Dasyurus maculatus*	V	E	The Spotted-tailed Quoll inhabits a range of forest communities including woodland, wet and dry sclerophyll forests, coastal heathlands and rainforests (Dickman & Read 1992; Edgar & Belcher 1995), more frequently recorded near the ecotones of closed and open forest (SFNSW 1995). Distributed on both sides of the Great Dividing Range and has been observed along the length of the NSW coast. Maternal den (breeding) sites are logs with cryptic entrances; rock outcrops; windows; burrows (EA 2000). Large areas of relatively intact vegetation are required by individual animals for foraging (NPWS 1999).	Low. The site contains isolated patches of remnant vegetation, however no continuous tracts of vegetation suitable for this wide-ranging species occurs.

Notes: 1.V = vulnerable, E = endangered.

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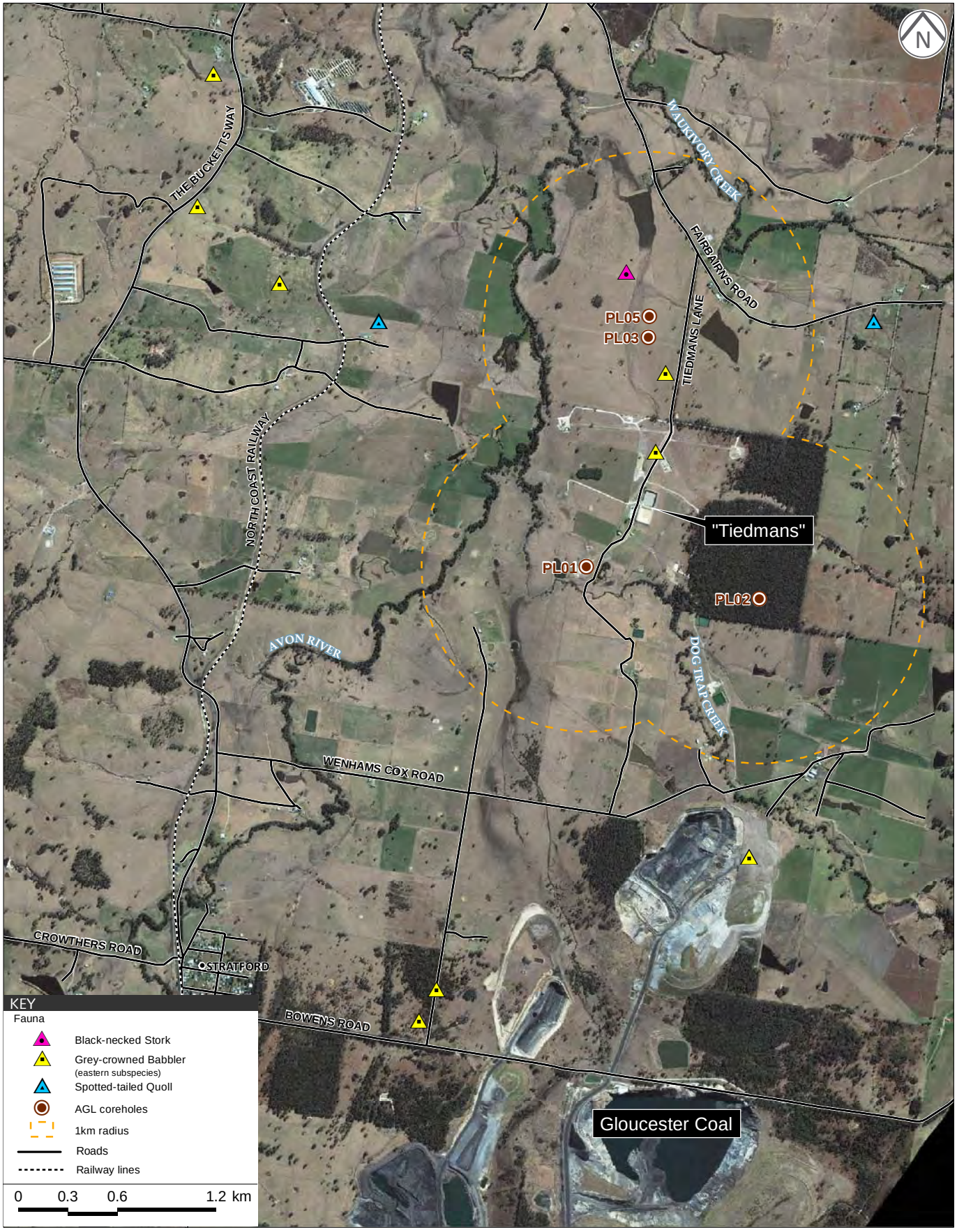

Source: Office of Environment and Heritage (OEH) - July 2011

OEH previously recorded threatened species

Proposed reservoir coreholes – Review of Environmental Factors

Figure 5.2

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ii Migratory species

The dams and riparian zones within the study area provide suitable habitat for a range of migratory species listed as matters of NES. One such species, the Cattle egret (*Bubulcus ibis*), was recorded during the survey within one of the dams surrounding the reservoir corehole areas.

Under the EPBC guidelines, a significant impact on a migratory species is likely as a result of an action if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

An area of 'important habitat' for a migratory species is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
- habitat that is of critical importance to the species at particular life-cycle stages; and/or
- habitat utilised by a migratory species which is at the limit of the species range; and/or
- habitat within an area where the species is declining.

The study area is not considered to be an important habitat for the cattle egret or any other migratory NES. It is unlikely that the works will result in any modification of habitat for such species as all waterways and dams will not be directly impacted by the works. It is possible that such species may be temporarily displaced from the immediate vicinity of the reservoir corehole areas during drilling due to indirect impacts such as drilling noise and disturbance from plant and drilling crews, however any such potential impacts will be temporary and are not considered to be significant.

iii Threatened ecological communities

The proposed reservoir corehole sites are located with the Hunter/Central Rivers CMA area and the Karuah Manning sub-catchment. A total of 12 threatened ecological communities are likely to occur within this CMA sub-catchment. Of these, only River-flat Eucalypt Forest on Coastal Floodplains was considered likely to occur given its known distribution.

River-flat Eucalypt Forest on Coastal Floodplains is a tall moist open forest to woodland that occurs on the river flats and terraces in the central to upper parts of the coastal floodplain. Dominant species include Forest red gum (*Eucalyptus teriticornis*), Cabbage gum (*Eucalyptus amplifolia*), Rough-barked apple (Angophora floribunda) and Broad-leaved apple (*Angophora subvelutina*).

The riparian area associated with the creekline 100 m to the south of the study area (from PL01) potentially contains this community. Rough-barked apple was a common species encountered close to the creekline during the survey which is indicative of the community's presence. As the proposed works are well away from this area and a number of control measures will be instated to minimise any potential

risk of indirect impacts from runoff associated with the works, the community's presence at the site was not investigated further and is not assessed further within this report.

5.5.4 Potential impacts on flora and fauna

i SEPP 44 – Koala Habitat Protection

Gloucester LGA is listed under Schedule 1 of SEPP 44 as koala habitat protection area. No known feed trees listed in Schedule 2 of SEPP 44 occur within the sites assessed. However one of the supplementary species known to be used by this species within the North Coast Management Area, Thin-leaved stringybark (*Eucalyptus eugenoides*) was found surrounding PL02 in remnant bushland. No evidence of koalas was observed during the site visit and no records occur within proximity to the study area. As such, the area is not considered to provide core koala habitat.

ii Corridors and connectivity

Most of the proposed reservoir coreholes are located on highly modified agricultural land. PL02 occurs within an isolated remnant which is not connected to any larger patches of vegetation. The proposed works will not isolate or fragment the existing remnant habitat further. Further, the works will not impact on fauna movement through the existing mosaic of habitats.

iii Indirect impacts

Indirect impacts to fauna could result of increased noise levels from drilling or related traffic movements on access roads. There is also the potential for sedimentation and erosion as a result of the pad construction and vehicular movements. Appropriate measures will be instated to minimise the potential for indirect impacts on flora and fauna of the area.

iv Key threatening processes

It is unlikely that any key threatening processes listed under the TSC Act or EPBC Act would be exacerbated by this proposal as the proposed reservoir coreholes have been located to avoid areas of native vegetation and riparian or seepage areas, and no native vegetation would be cleared or natural drainage patterns altered.

v Cumulative impacts

There is unlikely to be any cumulative impacts associated with the proposed works as it does not involve clearing of native vegetation and is being undertaken within a highly modified environment (ie a paddock). The area has already been subject to many investigations and pilot programs, however these are more intensive in nature than the current project. As such, the project will not significantly add to previous and future impacts associated with investigations in the locality.

5.5.5 Mitigation measures

The following mitigation measures are recommended to minimise any potential impacts on local ecology:

- Update the existing environmental management plan to include the proposed works. This may include:
    - onsite environmental management to advise contractors and other on-site personnel on ways of minimising ecological impacts. Personnel should be briefed on the importance of

the Grey-crowned babbler and laminated photos of this species and its nests placed in each vehicle for identification;

- traffic control measures will be required for the works. Slower speeds should be adhered to on the site to reduce the risk of fauna injuries;

- measures and requirements to ensure all drilling fluid is contained on site. No discharge of drilling fluid to waterways, aquatic and riparian environments would be permitted without suitable licences or approvals;

- measures to control weeds across the reservoir corehole site would be implemented;

- ongoing monitoring and, if necessary, restoration maintenance would be undertaken until grass cover has re-established;

- installation of sediment fences to prevent stormwater runoff and sediment entering the adjacent drainage pans and rivers;

- stockpiling of soil that may contain seeds of exotic species away from the creeks, drainage pans and other areas of native vegetation to prevent transportation to adjacent areas during rainfall or wind events; and

- measures to ensure that erosion and movement of sediments down slope do not occur during construction and these should include protection of bare ground with the use of jute mats or similar, weed control and revegetation of disturbed areas with pasture species.

- any identified Grey-crowned babbler nests should be avoided, appropriately sign-posted and included within any site toolbox prior to any construction activities;

- fallen timber and dead standing trees should not be removed for the works. If these are required to be removed, they should be placed nearby in suitable habitat and replaced after the works are complete;

- rubbish should be collected and removed off site to prevent it attracting pests, entering waterways and causing harm to fauna; and

- no chemicals, fuels or wastes should be stored within or near any natural or stormwater drainage lines. All substances are to be contained in sealed vessels of appropriate volumes and, where necessary, stored within bunded areas.

5.6 Aboriginal cultural heritage

5.6.1 Introduction

An assessment was conducted to identify the Aboriginal cultural heritage values pertaining to the specific areas to be impacted by the proposed activities. Cultural heritage values may pertain to physical sites of Aboriginal objects, particular significant historical associations with the particular areas or socio-cultural values associated with Aboriginal tradition. The most commonly identified Aboriginal heritage values in assessments of this nature relate to the presence of Aboriginal objects.

5.6.2 Methodology

The methods employed to identify Aboriginal cultural heritage values included a review of records identified in the Aboriginal Heritage Information Management System (AHIMS) maintained by OEH and a review of the recent comprehensive Aboriginal heritage assessment conducted for the related GGP by AECOM.

5.6.3 Background

The proposed impact areas occur on highly modified agricultural land, and have therefore been subject to significant disturbance over a number of years.

The Gloucester area was initially occupied by people of the Birpai language group, also known in the various literature as Biribay, Biribi, Birippi, Birrapee, Birripai, Birripi, Bripi, Brippai and Waw-wyper. According to Tindale (1974:192) this territory covered an area of some 7,300 km^2, extending from the Manning River at Taree south to Cape Hawke (near Forster) on the coast, and inland to the dividing range around Gloucester in the south west and the head of the Hastings River in the northwest.

Archaeological investigations have been limited in the area to a few coal mine assessments and the recent AECOM assessment cited above. AECOM (2009) report that there have been few archaeological surveys conducted in the Gloucester region, with only a few open stone artefact sites comprising small numbers of flaked stone tools recorded. Such sites typically comprise flaked stone artefacts distributed within the topsoil, and therefore are readily hidden in a grassed paddock. Typically areas of intact ground within 50 metres of a creek in the greater Hunter region are considered archaeologically sensitive based on the results of archaeological test excavations. Assessment of potential impact is therefore made on a predictive basis rather than on direct observation of open stone artefact sites.

5.6.4 Results

A review of the OEH AHIMS database (provided in Appendix A) indicates that there are two recorded Aboriginal sites or places within 1 km of the PL01, PL02, PL03 and PL05 sites. Details of these sites are provided in Table 5.8 below and in Figure 5.3.

Table 5.8 Known Aboriginal heritage items within 1 km of the proposed corehole sites

Site ID	Site Name	Site Features	Distance to the nearest reservoir corehole
38-1-0050	LEA2	Open site	555 m
38-1-0051	LEA3	Open site	545 m

Integrated Design Solutions | 030556 Rev C - 5 October 2011

Source: Office of Environment and Heritage (OEH) - July 2011

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AHIMS Records

Proposed reservoir coreholes – Review of Environmental Factors

Figure 5.3

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The sites, AHIMS IDs 38-1-0050 and 38-1-0051 are located at such a distance from the proposed reservoir corehole sites, that access and drilling activities are unlikely to result in any impacts to these items. The Aboriginal heritage items in the locality of the proposed reservoir coreholes are shown in Figure 5.3.

5.6.5 Legislative considerations

Aboriginal objects and Aboriginal places are protected by the NPW Act. Aboriginal sites are protected because they consist of Aboriginal objects. An Aboriginal place is defined in the Act as a place declared by the Minister that is or was of special significance with respect to Aboriginal culture. The Act includes a strict liability offence for harm to an Aboriginal object and provides significant penalties for individuals and corporation. An Aboriginal heritage Impact Permit (AHIP) must be obtained prior to harming Aboriginal objects. Applications to the OEH for an AHIP must show evidence of Aboriginal consultation in accordance with the NSW National Parks and Wildlife Regulation 2009 and follow published guidelines. The location of Aboriginal objects must be notified to OEH in the prescribed manner.

5.6.6 Mitigation measures

Although no Aboriginal heritage impacts were identified as part of the proposed works, Aboriginal heritage is still protected under the NPW Act. As such, all workers (including contractors) should be made aware that it illegal to destroy and Aboriginal item or artefact, and if it is considered that a potential Aboriginal item is uncovered during drilling works, all work is to cease and OEH is to be contacted.

5.7 Surface water

5.7.1 Existing environment

There are two watercourses in the vicinity of the proposed reservoir coreholes as identified in Figure 1.2. The Avon River lies to the west of the proposed drilling sites, approximately 600 m from PL01 and 700 m from PL03 and PL05. Dog Trap Creek, a tributary of the Avon River lies approximately 100 m south of PL01 and 430 m southwest of PL02. The confluence of the Avon River and Dog Trap Creek is approximately 790 m northwest of PL02, and 1 km southeast of PL03.

There is a drainage pan located approximately 70 m west of PL05 and 100 m to the west of PL03 that drains to a dam approximately 500 m north of the proposed drilling site.

5.7.2 Potential impacts

The potential impacts on surface water of the proposed reservoir coreholes and subsequent VWP(s) are from water (including stormwater) entering the drilling site or from water or sediment leaving the drilling site and flowing into nearby watercourses. Without appropriate controls in place, any water leaving the site may also contain oils and grease from operating machinery.

5.7.3 Impacts assessment and mitigation

During the preparatory works and drilling activities of the proposed reservoir coreholes and subsequent VWP(s), drainage and erosion control measures would be implemented to prevent potential off site surface water impacts by directing water flow around the drill pad ensuring water from adjacent areas does not flow into the pad area. These erosion and sediment control measures (see also Section 5.2.2) would be utilised to minimise the potential for sediment to move/migrate to nearby drainage lines. Specific control measures will include silt fences, hay bales or diversion drains.

In conjunction with the management of surface water on site, appropriate waste management would be implemented on site to minimise potential for surface water interaction with and oil, grease or other fluids. Drilling fluids and cuttings would be contained in on-site tanks to ensure no impact to surface water. Other measures would include ensuring fuel and lubricants are stored in appropriate places, degraded land is restored as soon as possible, and saline water is appropriately managed. As previously stated in Section 2, the temporary water tanks on site would be utilised for this purpose.

The following general measures would be implemented on the site:

- prohibition of petroleum based drilling fluids and additives in the drilling of the proposed reservoir coreholes;
- containment of contaminated water in tanks and where necessary removal and disposal at appropriate facilities;
- the prevention of discharge of drilling fluids and produced water to creeks;
- use of sediment fences/traps, diversion drains or hay bales to prevent soil loss;
- the storage of fuel and lubricants on-site would be minimised;
- bunding of oil and fuel storages and maintenance of a spill control kit on-site;
- provision and maintenance of spare tanks capacity to contain overflow from the main tank in the event of increased flow from the well;
- upslope drains would divert upslope runoff water around disturbance areas; and
- restoration of all disturbed ground immediately following completion of the works.

5.8 Flooding

The subject lots are not within the 'flood planning area' as identified in Gloucester LEP. A flood planning area is the area of land below the flood planning level (1 in 100 year flood plus a 0.5 m freeboard) and thus subject to flood related development controls. Thus, the site is not within a flood prone area.

5.9 Groundwater

5.9.1 Existing environment

i Groundwater depths, yields and levels

Within the Gloucester Basin, three types of aquifers have been identified during previous investigations (SRK Consulting, 2010). In order of depth this includes:

- shallow alluvial aquifer;
- shallow bedrock aquifer; and
- coal seam water bearing zones.

Many bores have been established for monitoring purposes in the Gloucester basin by various private resource companies with the remainder of bores/wells mostly being used for stock and domestic purposes. The primary aquifers across the catchment are the shallow alluvium associated with the major rivers and creek systems, and the shallow fractured bedrock up to around 70 m to 75 m in depth.

The maximum yield determined in alluvial bores and wells is 7.6 litres per second (L/s). The water bore yields from bores in the shallow fractured aquifer reported vary from 0.05 to 2 L/s. At depths greater than 150 m, bore yields decrease significantly and the coals seams are poor aquifers (most yields are less than 0.1 L/s).

Investigations undertaken within the Gloucester Basin stated that the depth to water in the shallow alluvial aquifer ranges from 2 m to 20 m, while in the shallow bedrock aquifer depth to water is generally 20 m to 40 m, although can be up to some 70 m to 75 m in some areas. In addition, the groundwater within coal seams is considered a very poor aquifer, and is generally confined and sub-artesian with most water coming from higher in the stratigraphic sequence (AECOM 2009).

These results were confirmed by SRK Consulting (2010) who reviewed the data available for registered groundwater bores in the Gloucester Basin. From a total of 128 registered bores/wells identified in the Gloucester Basin, the depth of the bores/wells varied from between 6 m to 66 m. Of these, four were located on an alluvial aquifer (6 to 9 m deep) while the rest were all deeper, at up to 66 metres, and sited in the shallow bedrock aquifer (Permian rocks). The majority of the bores and wells in the shallow bedrock aquifer had groundwater levels ranging from 1.5 m to 33.7 m below ground level (bgl). It is noted that studies undertaken at the Stratford coal mine, approximately 2 km south of PL01 and PL02 (refer to Figure 1.2), in the middle part of the Gloucester Basin identified pre-mining groundwater levels in the shallow bedrock aquifer as varying from 0.5 m to 16.3 m bgl. However, with the introduction of open-cut mining at Stratford it can be expected that some drawdown of these aquifers would have occurred in the surrounding areas, including the area of the proposed reservoir coreholes.

ii Groundwater quality

The AECOM (2009) report notes that within the shallow alluvial aquifer groundwater is fresh to brackish and is suitable for domestic (non-potable) and livestock consumption and irrigation (at selected sites). Groundwater in the shallow bedrock aquifer is brackish to slightly saline while within the deep coal seam zones, groundwater is slightly to moderately saline and is unusable for most purposes. These results suggest that the groundwater gets more saline (due to longer residence times) with depth.

The water quality from the alluvial and shallow bedrock aquifers indicates salinity (EC) values between 500 μS/cm and 1,900 μS/cm, while salinity values up to 9,600 μS/cm have been recorded for the deeper coal seams.

iii Groundwater flows

The current conceptual flow model for groundwater flow within the Gloucester Basin is described within the SRK Consulting report (2010). Ridges and rock outcrops are generally considered as being zones of preferred rainfall recharge. Outcropping aquifer zones, including the alluvial sediments along the valley floor, are recharged via direct infiltration of rainfall. Shallow fractured aquifers and deeper water bearing zones (eg coal seams) are recharged around the margin of the basin where individual formations outcrop.

Towards the centre of the Gloucester Basin, deeper coal seams are confined and artesian conditions are suspected in the rock water bearing zones.

Rainfall recharge rates to the alluvial aquifers are considered to be high. Recharge in the coal seam aquifers (deep aquifers) is considered to be relatively low, as evidenced by the poorer groundwater quality of the coal seams.

Discharge from all the hydrogeological units occurs by seepage to springs, rivers and streams. As the Gloucester Basin is a closed geological basin, most groundwater is expected to discharge in the lower catchment areas of the Avon River and Gloucester River in the vicinity of Gloucester.

iv Permeability

Investigations by Pacific Power in 1999 on 28 coal intervals indicated that coal seam intrinsic permeability decreases sharply with depth. At 100 m depth the intrinsic permeability averages 100 milliDarcy (mD) and at 300 m depth its range is 7 mD to 27 mD. SRK Consulting converted these intrinsic permeability values to hydraulic conductivity and measurements were below 10^{-2} m per day. Generally, shallow beneficial aquifers have hydraulic conductivity values greater than 10^{-2} m per day with alluvial aquifers generally above 1 m per day.

5.9.2 Impact assessment

The proposed reservoir coreholes will require drilling into the coal seams at a depth of either 400 m, 500 m or 800 m dependent upon the scenario chosen and implemented (refer to Section 2.1). Irrespective of the scenario implemented, the drilling activity will encounter the bedrock aquifer and the coal seam water bearing zones. The shallow alluvial aquifer is only expected to be encountered at the PL01 site.

Potential impacts to groundwater due to drilling activities for the proposed reservoir coreholes can be summarised as:

- Cross-contamination (ie connectivity) between aquifers (notably beneficial aquifers for stock and domestic purposes); and
- Leakage of drilling fluids/muds into an aquifer (notably beneficial aquifers for stock and domestic purposes).

The drilling activity requires approximately 100,000 L of freshwater per proposed corehole scenario. This volume of freshwater would be obtained from existing supplies at 'Tiedmans'. If supplies at 'Tiedmans' are not sufficient, water would be obtained from outside sources and appropriate licenses would be obtained as required. For Scenario 1 where two reservoir coreholes are proposed to be drilled, the 100,000 L would be split between PL01 and PL02 should this scenario be drilled. As discussed in Section 2.4.8, this freshwater is mixed to create a drilling mud with up to 3% of one or more combinations of potassium chloride, potassium sulphate, bentonite clay, ploy anionic cellulose, partially hydrolysed polyacrylamide, xanthium gum, acrylic polymer, anionic surfactants and sodium carbonate to facilitate the drilling of the corehole. The drilling mud is designed to maximise the stability of the reservoir corehole and to minimise any fluid losses during drilling activities. No petroleum based drilling fluids or additives would be used during the drilling process. Further information regarding the drilling fluids is provided in Section 2.4.8 and Appendix F.

As discussed in Section 2.4.2, the proposed reservoir coreholes will be cased as per the requirements of DTIRIS. All casings are cemented in place to ensure the zonal isolation and casing integrity exceeds the life of the reservoir corehole. The production casing is pressure cemented in place against the different geological strata (inclusive of aquifers) and integrity checked using cement bond geophysical logs. This evaluation tool provides confirmation that no mixing of groundwater from the strata occurs after the

corehole has been cemented. To achieve this objective, a hydraulic seal is obtained between the casing and the cement and between the cement and the formations for the life of the reservoir corehole.

The potential for drilling mud to infiltrate into the aquifer is also minimised through pumping of a cement slurry into the casing following completion of drilling and removal of drilling mud into tanks (refer to Section 2.5). Typically cement is brought much higher in the reservoir corehole – possibly even to the surface – to exclude other undesirable fluids from the reservoir corehole, to protect freshwater zones and to protect the casings from corrosion (PB, 2010).

Investigations within the Gloucester basin, as demonstrated in Section 5.9.1 above, indicate that groundwater within the coal seam water bearing zones is too low in yield and too high in salinity to be considered a beneficial aquifer. The beneficial groundwater levels in the vicinity of the proposed reservoir corehole sites are likely to be within the shallow alluvial aquifer and the shallow bedrock aquifer. In the vicinity of the proposed reservoir coreholes, these aquifers are at a depth of up to approximately 75 m. As such, groundwater contained in these zones (ie the upper alluvial and shallow fractured rock aquifers) would not be impacted by drilling as these different geological zones are cased and cemented off during the construction of the reservoir coreholes.

Additionally, the potential for drilling mud leaching through the ground from the surface into the shallow groundwater aquifer as a result of spills or leakage is minimised through the use of storage tanks (refer to Section 2.5). During the final stages of drilling, the drilling muds are pumped back to the surface into these storage tanks. Appropriate measures would be implemented to ensure there is no leakage from the tanks, and any water produced from the drilling process is disposed of into existing storage ponds at 'Tiedmans' or at an appropriately licensed facility.

5.9.3 Mitigation measures

The casing and cementing requirements during the drilling process, as outlined above, will ensure the integrity of the geological strata inclusive of aquifers.

As discussed in Section 2.4.9, tanks are proposed for the drilling pads to store any saline groundwater, which would be disposed of to 'Tiedmans' or at an appropriately licensed facility. These tanks would prevent infiltration of saline waters from the surface to any shallow aquifers. No drilling muds are to be discharged to drainage lines or creeks.

Upon completion of drilling activities, the proposed reservoir coreholes are to be plugged or capped in accordance with industry best practice and their future intended use as either a monitoring bore or production well pending the relevant further environmental and/or planning approvals.

To ensure the impacts of drilling mud is minimised, the following mitigation measures are recommended:

- no petroleum based drilling fluids or additives would be used during the drilling process;
- all water based drilling fluids would be contained in a series of tanks onsite;
- any water remaining in the tanks at the completion of drilling is to be disposed of at an appropriate facility; and
- any drilling fluids with excessive amounts of polymer or other additives are to be disposed of at an appropriate licensed facility.

The proposed reservoir coreholes are within the approved GGP area but do not form part of that approval. Whilst the management of the proposed VWPs would be conducted through the EMP, provided in Appendix D, the proposed VWPs would be incorporated into the broader groundwater monitoring network for the GGP to assess the depressurisation of the coal seams water bearing zones and the potential connectivity with the groundwater aquifers in this northern part of the Gloucester Basin.

5.10 Air quality

5.10.1 Existing environment

The area surrounding the proposed reservoir corehole scenarios is typical of a rural environment. It does not experience significant dust effects from activities, including either nearby mining or agricultural activities. The major land use is agriculture, namely grazing, with large areas of pasture and minimal cultivation. Therefore there are no significant areas of exposed soil which would be susceptible to wind erosion. The primary source of dust in the area is from vehicle movements over farm tracks. Sources of air pollutants are emissions from vehicles and farm machinery.

5.10.2 Impact assessment

Air emissions associated with the proposed activities are limited to dust from ground disturbance and vehicle emissions. The potential for dust generation is minimal given that a majority of site access will be by established farm vehicle tracks. There is potential for dust emissions to occur during the course of the preparatory works; however these works would be small in scale and short in duration. As a result, a temporary minor increase in dust generation is unlikely to be perceptible to what already presently occurs in the vicinity of the proposed sites.

There is potential for air quality impacts as a result of the increased vehicle movements associated with drilling activities (see also Section 5.11). These are likely to be negligible as the proposed drilling activities are short-term in duration, and the sites will not be heavily trafficked during the course of the works.

5.10.3 Mitigation measures

The following environmental management measures will be implemented during the proposed activity to maintain existing air quality, and to minimise the potential for emissions that may cause public concern:

- speed limits will be reduced on gravel tracks to reduce dust emissions;
- speed limits will be strictly enforced on all access tracks;
- in the event of dry conditions, dust creation will be monitored and water carts employed for dust suppression should they be required;
- if soil is stockpiled, stockpiles will be stabilised during high wind conditions to prevent dust creation;
- plant and equipment will be regularly maintained and serviced to limit the amount of vehicular pollution; and
- vehicles and equipment will be switched off when not in use.

5.11 Traffic

5.11.1 Existing environment

The main road in the vicinity of the proposed reservoir coreholes is The Bucketts Way (Main Road No. 90). The roads that are proposed to be used for accessing the subject lots are local roads managed by Council. The main access points to the proposed reservoir coreholes would be by Fairbairns Road, from The Bucketts Way. Fairbairns Road and Tiedmans Lane would be used to access the proposed corehole sites. These roads will also be used to access the VWP(s) when they are in operation.

5.11.2 Impact assessment

In addition to the primary traffic generating activities of the proposed activities (water truck movements), there would also be some minor and relatively infrequent additional traffic movements associated with the proposed works. Drilling contractors would be required to access the proposed sites, and some materials would need to be delivered to site. Some AGL employees (ie geologists, technicians, supervisors) would visit the site on occasion. The drill rig and ancillary equipment would be brought to the work sites.

The primary component of these traffic movements is the transportation of water, however, this volume includes trucks for both the importing of water for the initial phases of the drilling process as well as the disposal of production water. For each proposed reservoir corehole scenario it is estimated that the truck movements would represent a maximum of approximately 30 truck movements, inclusive of deliveries of water to site prior to commencement of drilling.

The proximity of the proposed reservoir corehole scenarios to the 'Tiedmans' property will mean that a majority of traffic movements associated with the transportation of water will be either; within 'Tiedmans' (PL01 and PL02), or a short distance along Tiedmans Lane (PL03 or PL05), an unsealed road used almost exclusively by the proponent and the adjacent landowner. Therefore, it is unlikely that the proposed activities will result in any significant traffic impacts on the surrounding network. In addition, given the size of the work crew and relatively short timeframe needed to undertake the drilling it is considered that the existing road network will have sufficient capacity to handle the traffic generated by the proposed works.

5.11.3 Mitigation measures

As part of AGL's commitment to the community, appropriate notification would be afforded to the nearby residents indicating when the drilling would commence. AGL would also maintain a community phone hotline for any concerns residents may have about the works including the truck movements.

All vehicles should be maintained according to the manufacturer's specifications. Other noise based controls relating to vehicles are identified in Section 5.4.

It is envisaged that any access tracks constructed for the wells would be designed to be low impact (eg gravel). Once drilling activities are completed the tracks are rehabilitated in respect of the current agricultural land uses on the sites and with the agreement of the landowner.

5.12 Other environmental aspects

5.12.1 Visual amenity

i Impact assessment

As previously described, the landscape surrounding the proposed reservoir coreholes is predominantly highly modified agricultural land, comprising pasture grasses and remnant native vegetation. The proposed reservoir coreholes are located in a valley between two mountain ranges, Mount Mograni to the east and the Gloucester Buckets to the west. The relief at the sites is flat to gently undulating. There are a number of residences in proximity to the proposed sites that are likely to receive filtered views of the proposed activities. However, the combination of intervening remnant vegetation and relief, and the existing agricultural and mining activities in the areas surrounding the proposed reservoir coreholes mean that the proposed activities are unlikely to feature significantly against the existing landscape.

ii Mitigation measures

As the proposed drilling activities are small in scale and short-term in duration, and given the existing landscape surrounding the proposed sites it is unlikely that they will significantly negatively impact the visual amenity of the area, and as such mitigation measures beyond those in the GGP EMP are not required.

5.12.2 Bushfire

i Impact assessment

There is a bushfire risk due to the presence of open pastures surrounding the proposed reservoir coreholes sites.

ii Mitigation measures

To minimise risk, contractors would be required to:

- minimise the on-site storage of fuel and ensure that it is safely stored at all times;
- ensure facilities for fire fighting purpose are maintained on site, including a water pump and hoses;
- prohibit smoking and cease any activities which could cause sparks on days of extreme fire danger; and
- prohibit the lighting of fires on-site.

5.12.3 Contamination

i Existing environment

The land use history of the subject lots has been predominantly agricultural. The site has been degraded from these uses.

A search of orders issued by OEH under the NSW *Contaminated Land Management Act 1997* and actions taken under the NSW *Environmentally Hazardous Chemicals Act 1985* revealed no orders or actions have been issued for the subject sites within the immediate vicinity.

ii Impact assessment

During the drilling program no soil is proposed to be removed from the compound site, other than samples taken for laboratory testing. On the completion of drilling all excavated material would be backfilled and rehabilitated.

iii Mitigation measures

It is noted that during any works, if any materials are encountered that are different (ie observable colours, discolouration or staining) an assessment of the materials should be undertaken by a NATA accredited laboratory.

5.12.4 Waste

i Impact assessment

There may be a minimal amount of waste (eg gravel, empty containers) generated as part of the proposed works.

ii Mitigation measures

A waste management plan is included as part of AGL's overall EMP, provided in Appendix D, and will be updated prior to any works taking place, if required. The plan shall also make consideration of the resource management hierarchy principles outlined in the *Waste Avoidance and Resource Recovery Act 2001*, if appropriate. AGL should make any contractors aware of the need to manage waste in accordance with the POEO Act, and OEH's Waste Classification Guidelines.

5.12.5 Erosion and sediment control

i Impact assessment

Site preparation for each of the proposed reservoir coreholes would involve minor earthworks for the construction of the drilling pads. Some gravel may be brought in to construct access tracks. This disturbance creates the potential for increased erosion and sedimentation.

ii Mitigation measures

As part of the proposed works an erosion and sediment control plan would be prepared which would consider:

- exposing the smallest possible area of land for the shortest possible time;
- saving topsoil for reuse;
- controlling runoff onto, through and from the site;
- using erosion measures to prevent on-site damage;
- using sediment control measures to prevent off-site damage;
- rehabilitating disturbed areas quickly; and

- maintaining erosion and sediment control measures.

Consideration should also be afforded to the principles outlines in the Landcom guidelines 'Managing Urban Stormwater: Soils and Construction' (known as the "Blue Book").

5.12.6 Acid sulphate soils

A search of the Natural Resource Atlas revealed that the proposed reservoir coreholes and access routes are not located in an area of acid sulphate soils risk. Nevertheless, careful soil management during the proposed activities, as outlined in Section 5.2.3, will minimise risks of impacts to soils.

5.12.7 European heritage

A search of the NSW Heritage database and Australian Heritage database revealed no items of state or national significance within the vicinity of the proposed reservoir coreholes and site access routes. A search of Gloucester LEP also revealed no items of local or regional heritage significance within the vicinity of the proposed works. Overall, it is considered that there would be no heritage items or areas impacts by the proposed activities.

5.12.8 Socio-economic and community considerations

Due to the limited duration of the proposed reservoir coreholes, no significant social impacts are expected from the works. AGL is not expected to employ a large workforce that would require an upgrade of existing community and recreational facilities in the area. There would, however, be positive socio-economic affects associated with proposed short term works including the flow on effects of employees spending their income on accommodation, food and entertainment in the local area.

5.13 Cumulative impacts

This REF has considered the cumulative environmental impacts of both of the proposed reservoir coreholes, the installation and ongoing monitoring of VWP(s) and site access routes, and recommended a number mitigation and management controls to ensure that the proposed works have a negligible impact on the local environment and community. AGL and its contractors would also be required to undertake works in accordance with AGL's EMP and the recommendations of this REF, to ensure the reservoir coreholes would have a negligible impact on the local environment.

Overall, it is considered that if the recommendations of this report and appropriate controls are in place during the works the development is unlikely to have any cumulative environmental impact.

5.14 Summary

The issues that have been identified as a result of the proposed reservoir coreholes are based on the investigations undertaken as part of this REF, and management and mitigation measures outlined should complement those identified in AGL's EMP. All workers on site should comply with the recommendations of this REF and AGL's EMP.

6 On-site management of works

6.1 Safety and risk management

6.1.1 General site management

A Safety Management Plan should be prepared and be available on site for all employees and contractors. The site management plan would also include safety and risk management. A site induction should be undertaken with all employees and contractors.

6.1.2 General safety procedures

The following procedures would be implemented on the proposed reservoir coreholes:

- suitable protective clothing, headgear and footwear are to be worn at all times in accordance with Workcover requirements;
- a comprehensive first aid kit, including a snake bite kit is to be available at all times on site;
- a reliable system of communication would be maintained on site to enable accidents to be reported and medical assistance to be obtained, if required;
- all equipment is to be maintained according to the manufacturers specifications;
- all contractors would be required to use their own discretion as to whether working conditions are safe in the case of heavy rain, strong winds, extreme fire danger or electrical storms;
- fire fighting equipment should be available in case of a bushfire;
- appropriate signage for safety requirements would be placed at or near all gates, if required.

6.1.3 Traffic management

As discussed previously, traffic control will be required to ensure the safe movement of other vehicles and pedestrians/cyclists using public roads in the vicinity of the works.

6.1.4 Stock and injury loss

If there is stock present at 'Tiedmans', or the neighbouring property on which PL03 and PL05 are located, during the course of the works appropriate management measures and speed limits to prevent any stock or native animals (eg kangaroos) entering the work area will be required. Smaller animals would be discouraged from entering work compounds by ensuring all rubbish is correctly disposed.

6.2 General environmental management of works

Any contractor(s) who undertakes work on the subject sites would be required to have any understanding of AGL's EMP. A copy of the EMP is provided in Appendix D. The EMP is kept on site together with an Emergency Response Procedure (ERP) and Safety/Site Management Plan.

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7 Conclusion

7.1 Management and mitigation measures

This REF has assessed the potential environmental impacts of the proposed reservoir corehole scenarios located near Gloucester, NSW. Environmental investigations prepared for the proposed sites assessed the corehole locations in their broader environment. The REF has been prepared in accordance with the EP&A Act and EP&A Regulation.

The results of the environmental investigations prepared for this REF anticipate that the proposed reservoir coreholes would have no significant impacts on the environment. The assessment identified environmental interactions, such as noise, which would require the implementation of prescribed mitigation measures in order to minimise potential impacts resulting from the proposal. It should be noted that the identified noise issues would occur over a short timeframe.

A summary of issues raised during the preparation of this REF and proposed mitigation and management controls are identified in Section 5. Section 7.2 assesses the proposal against the requirements of clause 228 of the EP&A Regulation, which is required when preparing an REF under section 111 of the EP&A Act.

Overall, if the recommendations of this REF are followed, and the drilling program is implemented in accordance with current environmental standards and guidelines, including AGL's EMP, the proposed works should not have a significant impact on the environment.

7.2 Compliance with clause 228 of EP&A Regulation

It is considered that the proposed reservoir coreholes are compliant with clause 228 of the EP&A Regulations, as outlined in Table 7.1.

Table 7.1 Compliance with clause 228

Factors to Consider	Compliance
Any environmental impact on a community.	The proposed works would have no significant impact on the community. Appropriate mitigation and management measures for potential environmental issues have been identified in this REF and would be included with AGL's EMP. These management methods, and the proposed development would be in accordance with Australian Standards and industry best practice.
Any transformation of a locality.	The proposed works have been identified to comply with the requirements of PEL 285. The proposed works are exploratory and are short term in nature. Affected landholders and nearby residents have been consulted about these reservoir coreholes, inclusive of potential future use of PL05 as a production well, and access tracks and would continue to be consulted as works progress. Appropriate environmental controls have been identified that should be implemented during works. If so, there would be no transformation of locality as a result of the proposal.
Any reduction on the aesthetic, recreational, scientific or other environmental quality or value of a locality.	The environmental assessments prepared for the proposed works have noted that the proposed reservoir coreholes would reduce the aesthetic, recreational, scientific or other environmental quality of the locality. The works would be undertaken in an existing environmental already disturbed by agricultural land uses. The proposed reservoir coreholes are exploratory and the works are short-term in nature, and are unlikely to cause any significant visual issues.
Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present of future generations.	The environmental investigations conducted on the subject sites have noted that the proposed works would not impact on the locality, Aboriginal cultural heritage, and non-indigenous heritage, nor social or visual significance of the area. The proposed works are unlikely to impact on flora and fauna, if the mitigation measures contained within this document are implemented. The proposed reservoir coreholes have been proposed as a results of the requirements of the PEL and community consultation has been undertaken. Ongoing consultations and implementation of an environmental management plan would also ensure that there are no long term impacts on the environment as a result of the proposed works.
Any impact on the habitat of protected fauna.	A flora and fauna assessment has been prepared for the proposed works which identifies that the proposed works are unlikely to impact on the habitat of protected fauna.
Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air.	A flora and fauna assessment has been prepared for the proposed works which identifies that the works would not have any impact on endangered species or ecological communities.
Any long-term effects on the environment.	An assessment has been made of any environmental impacts that may occur as a result of the proposed works. The works would be undertaken in an existing environment that is already largely disturbed. With appropriate management strategies in place, there would be no long term negative impacts on the environment.
Any degradation of the quality of the environment.	The environmental assessment prepared for the proposed works have not identified any degradation of the quality of the environment. The works would be undertaken in the existing environment which is disturbed as a result of previous agricultural activities. Appropriate removal of waste, including drilling fluids and produced water would be undertaken as part of the drilling works.
Any risk to the safety of the environment.	The proposed development does not pose any risk to the safety of the environment. The environmental assessment of the proposed works has not identified any significant impacts.
Any reduction in the range of	The assessment of environmental impact as a result of the proposed works has not identified any significant impacts. The subject sites are highly

Factors to Consider	Compliance
beneficial uses of the environment.	modified and works are proposed as a result of the requirements identified in the PEL. With appropriate management strategies in place at the drilling and logging stage there would be no reduction in the range of beneficial uses of the environment.
Any pollution of the environment.	The proposed reservoir coreholes would be drilled and logged over a relatively short timeframe. Appropriate erosion and sediment controls would be implemented as discussed. All drilling fluids and water would need to be stored on site and disposed of in an appropriate manner. There are some potential noise pollution issues as a result of the works. The installation of barriers and orientation of drilling equipment would allow noise levels to be managed at sensitive receivers in the vicinity of the reservoir coreholes. As noted, the noise will be short term, and no cumulative impact is expected.
Any environmental problems associated with the disposal of waste.	Any contaminated wastes uncovered during works should be removed and disposed of at an appropriate facility. All fluids and cuttings from the drilling process would be stored in tanks for disposal at an appropriate facility. Any general waste including oil containers would be disposed of appropriately. No impacts are expected from the works in relation to waste.
Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply.	The subject sites are highly modified and their small size means that the agricultural potential of the sites in today's market is relatively low. These reservoir coreholes are proposed for wireline logging. Following completion of drilling, the reservoir corehole will operate as VWP(s). However, should PL05 be drilled, it is proposed to be cased, cemented and suspended as a potential future production well pending further approvals. The reservoir coreholes are proposed in accordance with the requirements of the PEL as agreed with DTIRIS.
Any cumulative environmental effect with other existing or likely future activities.	The proposed works would not have any significant impact on the environment, now or into the future as discussed in Section 5. Appropriate mitigation and management of potential environmental issues, if adhered to, would ensure that the proposed reservoir coreholes have no significant impact on the environment. Any contractors would be required to undertake works in accordance with the recommendations of this REF and AGL's EMS. If works are undertaken in accordance with these requirements any potential impacts on the environment can be managed and reduce the risk of any impact to the environment. Overall, it is considered that if the recommendations of this report and appropriate controls are in place during the construction process the proposed activities are unlikely to have any cumulative environmental impact. Consultations would be ongoing with the community and key stakeholders such as DTIRIS to ensure that the works are undertaken in accordance with industry best practice and current standards.

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Appendix A

Database search results

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : J11034/35

Client Service ID : 46597

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
30-4-0006	Barrington Burial Site; Barrington West	AGD	56	396200	6460000	Open site	Valid	Burial : -	Burial/s	
Contact		**Recorders**	H Cooke,D.C Hardman,W Cook,Noma Naylor,Robert Cook					**Permits**		
38-1-0038	AGLG 1 (same as 38-1-0037)	GDA	56	397462	6439957	Open site	Valid	Artefact : -		
Contact		**Recorders**	MCH - McCardle Cultural Heritage Pty Ltd					**Permits**		
38-1-0035	AGL Gloucester PAD 1: Ward's River 2 (same as 38-1-0036)	AGD	56	399254	6436341	Open site	Valid	Potential Archaeological Deposit (PAD) : 0		
Contact		**Recorders**	Ms.Penny Mccardle					**Permits**	3166	
38-1-0051	LEA3	GDA	56	402096	6449859	Open site	Valid	Artefact : 1		
Contact		**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0054	LEA6	GDA	56	394945	6410460	Open site	Valid	Artefact : 1		
Contact		**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0061	PAD6 (Dungog)	GDA	56	397686	6417213	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
Contact		**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0062	PAD7 (Dungog)	GDA	56	396931	6417094	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
Contact		**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0064	PAD9 (Dungog)	GDA	56	393045	6409114	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
Contact		**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0041	DM4 Duralie Mine 4	GDA	56	399903	6429400	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
Contact		**Recorders**	Mr.Lance Syme					**Permits**		
38-1-0048	DM11 Duralie Mine 11	GDA	56	399039	6428901	Open site	Valid	Artefact : 1		
Contact		**Recorders**	Kayandel Archaeological Services					**Permits**		
38-1-0073	Gloucester Corroboree Ground	GDA	56	401917	6457955	Open site	Valid	Aboriginal Ceremony and Dreaming : -, Ceremonial Ring (Stone or Earth) : -, Potential Archaeological Deposit (PAD) : -		

Report generated by AHIMS Web Service on 12/07/2011 for Andrew Wiltshire for the following area at Datum :GDA, Zone : 56, Eastings : 388953 - 413589, Northings : 6403318 - 6468259 with a Buffer of 0 meters.Additional Info : Supporting information for an REF. Number of Aboriginal sites and Aboriginal objects found is 53

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : J11034/35

Client Service ID : 46597

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	**Recorders**	Mr.Steve Brereton					**Permits**		
38-1-0069	Gloucester RY 2	GDA	56	404672	6452597	Open site	Valid	Artefact : 1		
	Contact Mr.Robert Yettica	**Recorders**	Mr.Robert Yettica					**Permits**		
38-1-0055	LEA7	GDA	56	394770	6410201	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0065	PAD10 (Dungog)	GDA	56	391213	6407650	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Mr.Rick Bullers					**Permits**		
30-4-0002	Gloucester Ridgeview	AGD	56	404400	6459500	Open site	Valid	Stone Arrangement : -	Stone Arrangement	
	Contact	**Recorders**	Ray Kelly					**Permits**		
38-1-0068	Gloucester RY 1	GDA	56	405026	6452991	Open site	Valid	Artefact : 1		
	Contact Mr.Robert Yettica	**Recorders**	Mr.Robert Yettica					**Permits**		
38-1-0006	Washpool Bridge;	AGD	56	397660	6417050	Open site	Valid	Ceremonial Ring (Stone or Earth) : -	Bora/Ceremonial	
	Contact	**Recorders**	Mr.Brian Wythes					**Permits**		
38-1-0036	PAD1: Wards River 2	AGD	56	399254	6436341	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Ms.Penny Mccardle					**Permits**	3171	
38-1-0050	LEA2	GDA	56	402011	6449027	Open site	Valid	Artefact : 2		
	Contact	**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0039	DM2 Duralie Mine 2	GDA	56	399031	6429240	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Mr.Lance Syme					**Permits**		
38-1-0044	DM7 Duralie Mine 7	GDA	56	401058	6424633	Open site	Valid	Artefact : 6		
	Contact	**Recorders**	Mr.Lance Syme					**Permits**		
38-1-0028	Restriction applied. Please contact ahims@environment.nsw.gov.au.					Open site	Valid			
	Contact	**Recorders**	Mick Leon					**Permits**		
38-1-0003	Gloucester	AGD	56	402054	6457596	Open site	Valid	Modified Tree (Carved or Scarred) : -	Carved Tree	
	Contact	**Recorders**	David Bell					**Permits**		
38-1-0008	Craven Parkers Road	AGD	56	402890	6442590	Open site	Valid	Artefact : 4	Open Camp Site	835
	Contact	**Recorders**	Helen Brayshaw					**Permits**		
37-2-0336	MAN 31;Mt Arthur North;	AGD	56	398700	6421900	Open site	Valid	Artefact : -	Open Camp Site	1203,1204

Report generated by AHIMS Web Service on 12/07/2011 for Andrew Wiltshire for the following area at Datum :GDA, Zone : 56, Eastings : 388953 - 413589, Northings : 6403318 - 6468259 with a Buffer of 0 meters.Additional Info : Supporting information for an REF. Number of Aboriginal sites and Aboriginal objects found is 53

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : J11034/35

Client Service ID : 46597

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	**Recorders**	Margrit Koettig					**Permits**	147	
38-1-0056	PAD1 (Gloucester)	GDA	56	404041	6450702	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0040	DM3 Duralie Mine 3	GDA	56	400072	6429178	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Mr.Lance Syme					**Permits**		
38-1-0027	Honey Scarred Tree	AGD	56	401200	6425800	Open site	Valid	Modified Tree (Carved or Scarred) : -	Open Camp Site,Scarred Tree	
	Contact	**Recorders**	Michael Green					**Permits**		
38-1-0037	AGLG 1	AGD	56	397462	6439957	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Ms.Penny Mccardle					**Permits**	3172	
38-1-0049	LEA1	GDA	56	402611	6452503	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0052	LEA4	GDA	56	398996	6442117	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0042	DM5 Duralie MIne 5	GDA	56	399522	6427990	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Mr.Lance Syme					**Permits**		
38-1-0043	DM6 Duralie Mine 6	GDA	56	400187	6428274	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Mr.Lance Syme					**Permits**		
38-2-0095	Winns Creek Trail 2	AGD	56	412130	6416560	Open site	Valid	Artefact : -	Isolated Find	99964
	Contact	**Recorders**	Keith Gleeson					**Permits**		
38-1-0034	Mammy Johnson's Grave	AGD	56	400912	6424723	Open site	Valid	Burial : -		
	Contact Ms.Dianne Stephenson	**Recorders**	Mr.Steve Brereton					**Permits**		
38-1-0004	Stroud.	AGD	56	403333	6413463	Open site	Valid	Artefact : -, Ceremonial Ring (Stone or Earth) : -	Bora/Ceremonial,Open Camp Site	
	Contact	**Recorders**	Unknown Author					**Permits**		
38-1-0010	Little Black Camp Creek;	AGD	56	390980	6404750	Open site	Partially Destroyed	Artefact : -	Open Camp Site	1333
	Contact	**Recorders**	Warren Bluff					**Permits**		
37-2-0337	MAN 32;Mt Arthur North;	AGD	56	398700	6421800	Open site	Valid	Artefact : -	Open Camp Site	1203,1204
	Contact	**Recorders**	Margrit Koettig					**Permits**	147	

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : J11034/35

Client Service ID : 46597

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-1-0053	LEA5	GDA	56	398904	6440693	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0045	DM8 Duralie Mine 8	GDA	56	401206	6424225	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Mr.Lance Syme					**Permits**		
38-1-0047	DM10 Duralie Mine 10	GDA	56	398559	6428770	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Mr.Lance Syme					**Permits**		
38-1-0058	PAD3 (Craven)	GDA	56	399052	6439671	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0033	Honey Tree (002)	AGD	56	401160	6426300	Open site	Valid	Modified Tree (Carved or Scarred) : 1		101742
	Contact	**Recorders**	Barry Cain					**Permits**		
37-2-0348	MAN 25;Mt Arthur North;	AGD	56	399900	6421200	Open site	Valid	Artefact : -	Open Camp Site	1203,1204
	Contact	**Recorders**	Margrit Koettig					**Permits**	147	
30-5-0005	Tugrabakh;	AGD	56	406000	6463000	Open site	Valid	Ceremonial Ring (Stone or Earth) : -	Bora/Ceremonial	
	Contact	**Recorders**	E Nixon					**Permits**		
38-1-0046	DM9 Duralie Mine 9	GDA	56	398618	6428791	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Mr.Lance Syme					**Permits**		
38-1-0057	PAD2 (Craven)	GDA	56	399018	6439629	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0059	PAD4 (Craven)	GDA	56	399575	6436300	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0060	PAD5 (Craven)	GDA	56	399540	6434799	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Mr.Rick Bullers					**Permits**		
38-1-0063	PAD8 (Dungog)	GDA	56	394950	6410465	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Mr.Rick Bullers					**Permits**		

Report generated by AHIMS Web Service on 12/07/2011 for Andrew Wiltshire for the following area at Datum :GDA, Zone : 56, Eastings : 388953 - 413589, Northings : 6403318 - 6468259 with a Buffer of 0 meters.Additional Info : Supporting information for an REF. Number of Aboriginal sites and Aboriginal objects found is 53

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref Number : J11034/35

Client Service ID : 46597

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-2-0092	Darren 1	AGD	56	412050	6424000	Open site	Valid	Artefact : -	Isolated Find	
	Contact	**Recorders**	Keith Gleeson					**Permits**		
38-2-0093	Darren 2	AGD	56	411220	6420200	Open site	Valid	Artefact : -	Isolated Find	99964
	Contact	**Recorders**	Keith Gleeson					**Permits**		
38-1-0031	Isolated find no1	AGD	56	402400	6446625	Open site	Destroyed	Artefact : -		98114
	Contact	**Recorders**	Louise Gay,Robert Paulson					**Permits**	1374,2857,2858	

Report generated by AHIMS Web Service on 12/07/2011 for Andrew Wiltshire for the following area at Datum :GDA, Zone : 56, Eastings : 388953 - 413589, Northings : 6403318 - 6468259 with a Buffer of 0 meters.Additional Info : Supporting information for an REF. Number of Aboriginal sites and Aboriginal objects found is 53

NSW National Parks & Wildlife Service
atlas of nsw wildlife

Search Results

Your selection: Fauna, threatened species, Selected Area - 151.91951,-32.13761,152.01951,-32.03761 returned a total of 21 records of 6 species.
Report generated on 18/08/111 - 16:43 (Data valid to 25/04/2010)

view map | search again | clear selection

Choose up to 3 species to map.

** Exotic (non-native) species*

Aves	Map	Scientific Name	Common Name	Legal Status	Count	Info
Acanthizidae						
	☐	Pyrrholaemus saggitatus	Speckled Warbler	V	1	
Cacatuidae						
	☐	Calyptorhynchus lathami	Glossy Black-Cockatoo	V	1	
Ciconiidae						
	☐	Ephippiorhynchus asiaticus	Black-necked Stork	E1	2	
Pomatostomidae						
	☐	Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	13	
Strigidae						
	☐	Ninox strenua	Powerful Owl	V	1	

Mammalia	Map	Scientific Name	Common Name	Legal Status	Count	Info
Dasyuridae						
	☐	Dasyurus maculatus	Spotted-tailed Quoll	V	3	

** Exotic (non-native) species*

Choose up to 3 species to map.

OUR ENVIRONMENT it's a living thing

NSW National Parks & Wildlife Service
atlas of nsw wildlife

Search Results

Your selection: Flora, threatened species, Selected Area - 151.91951,-32.13761,152.01951,-32.03761 returned a total of 1 records of 1 species.
Report generated on 18/08/111 - 16:47 (Data valid to 25/04/2010)

view map | search again | clear selection

Choose up to 3 species to map.

** Exotic (non-native) species*

Plants	Map	Scientific Name	Common Name	Legal Status	Count	Info
Rubiaceae						
	☐	Asperula asthenes	Trailing Woodruff	V	1	

** Exotic (non-native) species*

Choose up to 3 species to map.

OUR ENVIRONMENT it's a living thing

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

EPBC Act Protected Matters Report: Coordinates

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Report created: 18/08/11 13:43:05

Coordinates

Buffer: 10.0Km

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Significance (Ramsar Wetlands):	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communitites:	None
Threatened Species:	20
Migratory Species:	15

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	4
Commonwealth Heritage Places:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None

Critical Habitats:	None
Commonwealth Reserves:	None

Report Summary for Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	4
State and Territory Reserves:	1
Regional Forest Agreements:	1
Invasive Species:	15
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

National Heritage Places [Resource Information]

Name	Status
Historic	
The Stroud Gloucester Valley NSW	Nominated place

Threatened Species [Resource Information]

Name	Status	Type of Presence
BIRDS		
Anthochaera phrygia		
Regent Honeyeater [82338]	Endangered	Species or species habitat may occur within area
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Lathamus discolor		
Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Vulnerable	Species or species habitat may occur within area
FROGS		
Litoria aurea		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area
Litoria booroolongensis		
Booroolong Frog [1844]	Endangered	Species or species habitat may occur within area
Mixophyes balbus		
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mixophyes iteratus		
Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat likely to occur within area
MAMMALS		
Chalinolobus dwyeri		

Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae		
New Holland Mouse [96]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys oralis		
Hastings River Mouse [98]	Endangered	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
PLANTS		
Allocasuarina defungens		
Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat may occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Cynanchum elegans		
White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
Eucalyptus glaucina		
Slaty Red Gum [5670]	Vulnerable	Species or species habitat likely to occur within area
Euphrasia arguta		
[4325]	Critically Endangered	Species or species habitat may occur within area

Migratory Species [Resource Information]

Name	Status	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat may occur within area

Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Breeding may occur within area
Monarcha trivirgatus		
Spectacled Monarch [610]		Breeding likely to occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Breeding likely to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Breeding may occur within area
Xanthomyza phrygia		
Regent Honeyeater [430]	Endangered*	Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis s. lat.		
Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land - Australian Postal Commission
Commonwealth Land - Telstra Corporation Limited
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Commonwealth Bank of Australia

Listed Marine Species [Resource Information]

Name	Status	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus		

White-throated Needletail [682]		Species or species habitat may occur within area
Lathamus discolor		
Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Breeding may occur within area
Monarcha trivirgatus		
Spectacled Monarch [610]		Breeding likely to occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Breeding likely to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Breeding may occur within area
Rostratula benghalensis s. lat.		
Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	Status
Historic	
Gloucester Soldiers Memorial NSW	Indicative Place
Vale of Gloucester NSW	Indicative Place
Folk Museum NSW	Registered
Gloucester Cottage NSW	Registered

State and Territory Reserves [Resource Information]

The Glen, NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

North East NSW RFA, New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Frogs		
Bufo marinus		
Cane Toad [1772]		Species or species habitat likely to occur within area
Mammals		
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area

Vulpes vulpes Red Fox, Fox [18]	Species or species habitat likely to occur within area
Plants	
Alternanthera philoxeroides Alligator Weed [11620]	Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]	Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]	Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]	Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]	Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]	Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]	Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]	Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]	Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtiji Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]	Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]	Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:
- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:
- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:
- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.0935 151.96725

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia

-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix B

Assessment of Significance

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Seven part test of significance for the Grey-crowned babbler under Part 5A of the *Environmental Planning and Assessment Act* 1979

The Grey-crowned babbler is listed as a vulnerable species in NSW under the TSC Act. The species occupy open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs (NSW Scientific Committee, 2001). The species builds conspicuous dome-shaped nests and breeds co-operatively in sedentary family groups of 2-13 birds (Davidson and Robinson, 1992). Grey-crowned Babblers are insectivorous and forage in leaf litter and on bark of trees. The species is considered very uncommon in the Hunter Valley with most family groups reduced to two or four members (P. Cowper, pers. comm. in NSW Scientific Committee, 2001).

A population of this species is known to occur within the study area along Tiedmans Lane. A number of nests were observed during the recent site visit in these areas within vegetation dominated by Ironbarks and Angophoras.

Option 1 involves two shallow coreholes at PL01 and PL02.

Option 2 involves a deep corehole (and larger pad site) at PL03. Option 3 involves another deep corehole at PL05 adjacent to the location of PL03. As such, Options 2 and 3 have been assessed together.

The following factors must be taken into account in making a determination under this section:

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

This species is gregarious living and breeding in family groups. The large nests form an important part of the lifecycle of this species, with the nests being re-used from year to year. All members of the family group remain close to each other when foraging. A soft 'chuck' call is made by all birds as a way of keeping in contact with other group members. As such, vocalisations and communication within the family group are also an important part of the lifecycle of the species.

Option 1

No individuals were observed or heard in or near the proposed corehole areas during the survey. Further, no nests were recorded within the proposed corehole pad site or along the access to the site. Corehole activities have occurred within the study area previously and it these do not appear to have adversely affected the population present, since family groups still occupy the study area. It is therefore unlikely that Option 1 will result in the adverse affect on the lifecycle of the species such that the local population would be placed at risk of extinction.

Options 2 and 3

PL03 and PL05 are located within a cleared agricultural paddock. There is little habitat within the pad sites, however access will be via Tiedmans Lane where babbler nests were found. In particular, a nest

occurs to the north of the proposed access location, within a juvenile eucalypt. However, this nest will not be directly impacted as a result of access and is already adjacent to the lane and thus exposed to edge effects from the current access. In addition, the works will be temporary in nature, although these will occur during the breeding season for the species. Mitigation measures will be employed to determine the use of the nest prior to any work occurring. Should it be found to be in use, another access to the site will be determined in conjunction with an ecologist.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse affect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

This section is not relevant as the Grey-crowned babbler is listed as a threatened species, not an endangered population. No endangered populations of the Grey-crowned babbler have been listed on the TSC Act in the study area.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

This section is not relevant as the Grey-crowned babbler is listed as a threatened species, not an endangered or critically endangered ecological community.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

(ii) whether an area of habitats is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Grey-crowned babbler require leaf litter and the bark of trees to forage for food. The proposed works may temporarily remove some areas of leaf litter, particularly in association with PL02. However this species has not been recorded in the vicinity of PL02 and therefore the temporary loss of this habitat will be minor. No roosting or nesting habitat will be removed for the works.

The proposed works will not further isolate, fragment or modify known habitat for this species as no trees or native vegetation patches will be directly impacted for the works. The majority of works will occur in areas which do not provide suitable habitat for this species.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

This section is not relevant as no areas of critical habitat have been listed for the Grey-crowned babbler under Part 3 of the TSC Act.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A recovery plan had not been prepared for this community at the time of writing. However, a number of actions required to assist the recovery of the species have been identified and include:

- retain existing woodland vegetation;
- retain dead timber on the ground in open woodland areas;
- encourage regeneration of habitat by fencing remnant stands; and
- increase the size of existing remnants, planting trees and establishing buffer zones of unimproved uncultivated pasture around woodland remnants.

The proposed works are considered to be consistent with these objectives as the coreholes will not require the removal of woodland vegetation and will allow for the retention of dead timber.

AGL also currently provides supplementary materials to educate all contractors on the Grey-crowned Babbler; this includes the provision of a laminated photo of the species in each vehicle.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The removal of dead wood and dead trees, which provide key foraging resources for the Grey-crowned Babbler, is listed as a key threatening processes listed under the TSC Act. The proposed activities have potential to contribute to this key threatening process, however this impact can be avoided through appropriate placement and mitigation of construction works. As such, it is unlikely that this key threatening process would be significantly exacerbated by the proposed activities.

Clearing of Native Vegetation is also listed as a key threatening process under the TSC Act. No trees will be removed however some understorey around the pad site for PL02 may be required to be removed for the works should Option 1 proceed. This small amount of understorey clearing is not considered to constitute a significant threat to this species.

Other threats identified for this species by OEH include clearing of woodland remnants, heavy grazing, degradation of habitat by stock, fire, and nest predation by bird species. None of these threats would be increased as a consequence of this proposal.

Conclusion

The proposed activity may result in indirect impacts on a small sub-population of the Grey-crowned Babbler. This population occurs within a road easement and a small isolated vegetation remnant. The proposed action is unlikely to result in an adverse effect such that the species local would be placed at risk of extinction, due to existing disturbance at the site and the minor nature of the works. There is unlikely to be a significant impact on the Grey-crowned Babbler or its habitat as a result of the proposed corehole works. A Species Impact Statement is not required.

Appendix C

Noise impact assessment

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04 October 2011

Toni Laurie
Land & Approvals Manager
AGL Upstream Investments Pty Ltd
PO Box 335
Gloucester NSW 2422

Re: Proposed Reservoir Coreholes – Environmental Noise Assessment

Dear Toni,

1 Introduction

EMGA Mitchell McLennan Pty Ltd (EMM) has been engaged by AGL Upstream Investments Pty Ltd to conduct a noise assessment for the drilling of three proposed reservoir coreholes (PL01, PL02, PL03 and PL05) near Stratford, NSW using either an Ensign or Drilltec G55 rig.

This report assesses the potential construction noise impact from drilling of the coreholes. It is understood that fracture stimulation (fracing) is not required, and therefore this process has not been assessed in this report.

Construction of the coreholes will involve drilling and minor earthmoving activities to prepare for the construction pad.

Noise generated by operational activities will be relatively low in comparison to reservoir corehole construction activities and therefore has not been considered in this assessment.

2 Project description

The project description detail is provided in the Review of Environmental Factors prepared under Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in accordance with the conditions and requirements of Petroleum Exploration Licence 285 (PEL 285). From a noise perspective, the key elements include:

- The corehole drilling activity which will involve the implementation of only one of the following drilling scenarios:
  - Scenario 1 : two reservoir coreholes (PL01 and PL02), to a depth of approximately 400m and 500m respectively; or
  - Scenario 2 : one reservoir corehole (PL03), to a depth of approximately 800m; or
  - Scenario 3: one reservoir corehole (PL05), to a depth of approximately 800m.

- Drilling. Drilling of the reservoir corehole is typically undertaken with a trailer or truck mounted drill rig. The type of drill rig to be used is typical of rigs used for coal seam gas drilling. Given the location of the reservoir coreholes with respect to surrounding residences, comparison of typical rigs to be used, such as the 'Drilltec' rig and the quieter 'Ensign Rig', has been adopted in our assessment. It is expected that drilling will be conducted on a 24 hour basis for the duration of reservoir corehole construction for up to 20 days, dependant on confounding factors such as mechanical failure and weather disruptions. The drilling activity will be conducted on an existing constructed pad with an area of approximately 60m by 70m. With ancillary equipment, the pad maybe expanded to an area of 100m by 100m, dependent upon identified site constraints.

- Wireline logging. Once the drilling of the proposed reservoir coreholes has reached the target depth, downhole wireline geophysical logging would be undertaken for the full depth over a period of up to two days at each borehole. The geophysical logging involves the lowering of probes into the proposed reservoir corehole which is specifically designed to record strata characteristics as the probe is slowly raised in the reservoir corehole.

- Water monitoring piezometer. A monitoring piezometer may be located at any of the reservoir coreholes, depending on the drilling scenario that is selected. The pad upon which the piezometer would be developed is anticipated to be within the pad used for the drilling of the reservoir corehole. The installed logger in the monitoring piezometer would constantly measure water pressure and level.

- Future production well. Should PL05 be drilled as a reservoir corehole, it will be cased, cemented and suspended for a potential future production hole pending further environmental and planning approvals.

3 Noise Goals

3.1 Construction noise

The construction component of the project will include site preparation, establishment and drilling of the corehole.

3.1.1 Interim construction noise guideline

The NSW Office of Environment and Heritage (OEH), formerly the Department of Environment, Climate Change and Water (DECCW), provides the Interim Construction Noise Guideline (ICNG) for the assessment and management of noise from construction works.

The ICNG provides two methodologies for the assessment of construction noise emissions:

- quantitative, which is suited to major construction projects with typical durations of more than three weeks; and

- qualitative, which is suited to short term infrastructure maintenance (less than three weeks).

The resultant methodology for a quantitative assessment requires a more complex approach, involving noise emission predictions from construction activities to the nearest sensitive receivers, whilst the

qualitative assessment methodology is a more simplified approach that relies more on noise management strategies.

The proposed construction duration could be in excess of three weeks (up to 20 working days) with activities expected to occur during day and night time periods. The quantitative assessment methodology is the most suitable assessment methodology for this proposal. Table 1 is an extract from the ICNG, providing guidance for residential receivers only.

In addition, the OEH suggests the following time restriction for the construction activities where noise is audible at residential premises:

- Monday to Friday 7:00 am to 6:00 pm;
- Saturday 8:00 am to 1:00 pm; and
- No construction work is to take place on Sundays or public holidays.

Table 1 ICNG residential criteria

Time of Day	Management Level $L_{Aeq\ (15\ min)}$*	How to Apply
Recommended standard hours: Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: i) times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences ii) if the community is prepared to accept a longer period of construction in

Table 1 ICNG residential criteria

Time of Day	Management Level $L_{Aeq\ (15\ min)}$*	How to Apply
		exchange for restrictions on construction times
Outside recommended standard hours	Noise affected RBL + 5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2.

In summary, the ICNG noise level goals for activities during the standard hours are 10 dB above the existing background levels. For activities outside of the standard hours the noise levels should be no more than 5dB above the existing background levels.

A 'short-term' background noise assessment was undertaken during the daytime on 28 June 2011 in the general vicinity of PL01 resulting in an $L_{90,15minute}$ of 32 dB(A). Therefore, as there is no other substantial existing background noise data at the surrounding sensitive residences, this assessment adopted a conservative approach of setting a background noise level of 30 dB(A), typical of rural environments. This approach is consistent with the guidelines of OEH's Industrial Noise Policy (INP). The residential construction noise criteria for the proposal are therefore provided in Table 2.

Table 2 Residential construction noise criteria

Location	$L_{Aeq,\ 15min}$ Noise Criterion, dB(A)
Residential Assessment Locations	40, ie background plus 10 dB (recommended hours) 35, ie background plus 5 dB (Out of hours)

3.2 Sleep disturbance criteria

The aforementioned criteria, which consider the average noise emission of a source over a specified time, are appropriate for assessing noise from relatively steady-state sources, such as drilling noise and other

equipment. However, on-site sources such as truck reversing alarms and hand tool clangs are intermittent (rather than continuous) in nature, and as such, need to be assessed using the L_1 or L_{max} noise metrics.

The most important impact of such intermittent noises would be to disturb the sleep of nearby residents during the OEH defined night period of 10:00 pm to 7:00 am.

The OEH's Environmental Criteria for Road Traffic Noise (ECRTN, 1999) policy indicates that levels below 50 dB(A) to 55 dB(A) inside residences are unlikely to wake sleeping occupants. The likely number of noise events per night should also be considered. If bedroom windows are open, this corresponds to an external maximum noise level of approximately 60 dB(A) to 65 dB(A) at a residence. However, this is considerably higher than the OEH's current position on sleep disturbance which is that L_1 or L_{max} noise from a source should not exceed the existing background noise level by more than 15 dB and hence the proposed night time criterion for the adopted representative locations becomes:

- 45dB(A)L_{max}, for intermittent type of events from the reservoir corehole site alone.

For the purpose of this assessment, the descriptors L_{max} and L_1 may be considered interchangeable.

Nearby receivers

4 Predicted Noise Levels and Impact Assessment

The prediction of noise from the construction associated with three proposed reservoir coreholes was undertaken using mathematical calculations based on provided sound power level data and sound level loss through air over distance. This calculation methodology is considered conservative due to the relatively flat topography and distance between the source and receiver.

4.1 Noise assessment locations

The closest and potentially the most exposed noise sensitive receivers to the reservoir corehole sites are residences as listed in Table 3, along with the nearest distance to the reservoir corehole construction works The proposed reservoir corehole and noise assessment locations are shown in Figure 1.

Table 3 Noise assessment locations

Location (Figure 1 Ref.)	Nearest distance to reservoir corehole works (m)
1	470 (to PL03) / 366 (to PL05)
2	1,800 (to PL01)
3	1,315 (to PL02)

4.2 Construction noise levels

The drilling activity for the reservoir corehole is expected to occur for up to 20 working days. It is expected that drilling will be required to occur day and night for this period due to the local geology, reservoir corehole conditions and integrity, and for safe operations.

Whilst preparatory and other activities occur prior to and in between site establishment and drilling, the noisiest construction activities are drilling. Hence only drilling activities were assessed in detail.

4.2.1 Sound emission input data

For the assessment of noise from the proposed drilling activities, sound emission or power levels used to predict received noise levels were extracted from previous noise audits conducted by SLR Heggies, Report 30-2131 Ensign Drill Rig 20100927 (2010) and Atkins Acoustics Report 38.6395 Construction Noise Assessment (2009). The reports identified that the overall noise emission of each unit varied significantly with respect to its orientation. Table 4 presents an upper and lower sound power level for each drill rig, with the lower levels reflecting optimised or 'rear' facing/orientation of each unit.

Table 4 Worst case and optimised plant layout sound power levels

Source	Octave Band Centre Frequency Noise Level, dB(Z)									Overall SWL, dB(A)
	31.5	63	125	250	500	1k	2k	4k	8k	
Ensign Rig (overall)[1]	116	108	111	103	98	99	96	93	87	**104**
Ensign Rig (optimised)[1]	120	106	104	98	93	94	91	88	84	**99**
Drilltec G55 (overall)[2]	110	112	113	109	105	103	98	92	82	**108**
Drilltec G55 (optimised)[2]	103	105	106	102	98	96	91	85	75	**101**

Note 1: Source: SLR Heggies report (2010)
Note 2: Source: Atkins Report (2009)

4.2.2 Construction noise levels

A summary of calculated worst case noise levels for drilling and reservoir corehole construction activities for the nearest residential location to each drilling location are presented in Table 5. These residences are representative of the potentially worst affected by proposed construction works.

Table 5 Worst case construction noise levels for drilling reservoir coreholes, dB(A)

Location (Figure 1 Ref.)	Ensign Rig		Drilltec G55		Leq Noise Level Criteria, dB(A)		
	Overall	Optimised	Overall	Optimised	Standard hours	Out of hours	Highly noise affected
1[1]	43	38	47	40	40	35	75
2	26	21	30	23			
3	29	24	33	26			

Note 1: Based on received noise levels from PL05 for a distance of 366m.

The predicted drilling noise levels using the Ensign or Drilltec rig is expected to satisfy all criteria at locations 2 and 3. For location 1, noise levels comply with the standard and highly noise affected criteria and exceed the out of hours criteria by up to 3 dB using the Ensign rig and 5 dB using the Drilltec rig, or equivalent, for the drilling of either PL03 or PL05.

Therefore, it is recommended that when drilling operations occur during standard hours at PL03 or PL05 that either drilling rig be orientated with the rear of the unit facing the residence (location 1). This would see the daytime criteria achieved.

The predicted drilling noise levels for both drills are expected to satisfy the standard, out of hours and highly noise affected criteria for locations 2 and 3. The noise levels at location 1 are predicted to exceed the out of hours criteria by up to 5 dB using the Drilltec rig and 3 dB using the Ensign rig. Therefore, when drilling is occurring in the vicinity of location 1 (ie PL03 or PL05), noise management and mitigation are recommended. This may include the use of temporary noise barriers, which would result in satisfying all criteria at all times if designed appropriately.

4.3 Sleep disturbance noise predictions

Noise from possible intermittent activities include hammering using hand tools, metal to metal contact associated with out of hours drilling and similar activities. A typical source sound power (emission) level of 115 dB(A) was used to predict maximum (Lmax) noise at receivers. Table 6 presents the predicted L_{max} noise levels assessed against the sleep disturbance criterion (45 dB(A)).

Table 6 Predicted Lmax noise levels, dB(A)

Activity	Locations	L_{max} noise emission, dB(A)	L_{max} Sleep Disturbance Criterion, dB(A)
Corehole construction (No Barriers)	1	55	45
	2	42	45
	3	44	45

Noise emitted from these activities should be controlled and managed by appropriate measures when working out of hours at PL03 and PL05. The results do not include the benefits of barriers, which if designed appropriately would reduce levels to satisfy criteria at all locations (i.e. 55 dB(A) minus 10 dB for barrier, results in a 45 dB(A) L_{max} level).

4.4 Noise management and mitigation

The primary objective of the noise management strategy is to minimise noise impacts on the surrounding community. The Project Manager may adopt the following noise management strategies to reduce emissions:

- orientate the drill rig to take advantage of directional noise characteristics for the closest residence for the given reservoir corehole site as described in this report;
- ensure the community is consulted and provide them with written notice well in advance of proposed activities;
- where possible obtain a drill rig with lower noise emission levels; and
- employ all reasonable and feasible work practices to minimise any impacts.

4.4.1 Construction works at PL03 and PL05

During drilling operations at PL03 and PL05, the following mitigation strategies to manage noise are recommended:

- where possible, drilling machinery will be located / orientated to direct noise away from the closest sensitive receivers;
- undertake regular maintenance of drilling machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers;
- the quietest suitable machinery reasonably available will be selected for each work activity;
- the offset distance between noisy items of plant/machinery and nearby sensitive receivers will be maximised;
- where practicable, ensure those noisy plant/machinery are not working simultaneously in close proximity to sensitive receivers; and
- the use of mobile screens or barriers will be adopted for drilling during out of hours periods when working at PL03 and PL05.

5 Conclusion and Recommendations

EMM has completed a construction noise impact assessment of the proposed drilling of each of the three reservoir corehole scenarios (PL01, PL02,PL03 and PL05) near Stratford, NSW using sound power levels for either an Ensign or Drilltec G55 rig.

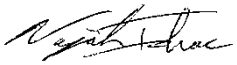
This assessment recommends mitigation of noise by orientating the drill rig to the optimised plant layout at all sites to reduce impacts at residences.

The assessment also finds that sleep disturbance issues at night can satisfy OEH criteria at two of the three assessed residential locations. At PL03 and PL05, the adoption of mobile barriers to shield the activities from neighbouring receivers is recommended to achieve criteria.

We trust that the above information satisfies your needs and if you have any further questions please contact the undersigned.

Yours sincerely

Oliver Muller
Associate, Senior Acoustic Scientist (MAAS)
omuller@emgamm.com



Najah Ishac (MEngSc, BE, MIEAust, MAAS)
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Appendix D

Environmental management plan

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AGL Upstream Investments Pty Ltd

PROCEDURE

ENVIRONMENTAL MANAGEMENT PLAN

GLOUCESTER BASIN (PEL 285)

COAL SEAM METHANE GAS – EXPLORATION DRILLING AND PRODUCTION EVALUATION TESTING

Gloucester Gas Project

ENVIRONMENTAL MANAGEMENT PLAN

AGL Upstream Investments Pty Ltd

Document Control
Environmental Management Plan

Approval:

Authorising Officer	David Kelly
Title	Head of Land and Approvals, Gas and Power Development
Signature	
Date	1/7/10

Revision Status:

Revision	Date	Prepared By	Checked By	Approved By	Comments
0	April 2009	TL	SG	SG	

TABLE OF CONTENTS

1.0 PURPOSE

AGL has developed this Environmental Management Plan (EMP) to control and manage the environmental impacts of its activities in undertaking exploration drilling and production evaluation testing for coal seam methane gas in the Gloucester Basin.

This EMP has been prepared under the framework of the ISO 14001 Environmental Management System (EMS) standard.

The AGL Energy Health, Safety and Environment Policy and documentation should be considered in parallel with this EMP to promote a better understanding of the requirements and standards implied.

2.0 INTRODUCTION

This EMP has been developed for the activities currently being undertaken as part of AGL's exploration and production testing activities in the Gloucester Basin, as well as a basis for those that are proposed for the future as the project develops.

2.1 Background

The Gloucester Basin is located in New South Wales, approximately 100 km north of Newcastle. AGL is the operator for exploration activities for coal seam methane gas in the basin. The area is administered under Petroleum Exploration Licence (PEL) 285, which enables investigation of resources with a view to possible development of a production field in the near future.

The location of the PEL area is approximately centred on the township of Stratford, some 70 kilometres (km) north of Newcastle in New South Wales (NSW). The area extends approximately 60 km north to south and approximately 20 km east to west comprising some 18 graticular blocks and about 1,308 square kilometres (km^2) (Figure 1). The area completely contains the Gloucester Geological Basin.

The project is a conventional coal seam methane gas project, involving petroleum exploration activities including drilling and production evaluation testing.

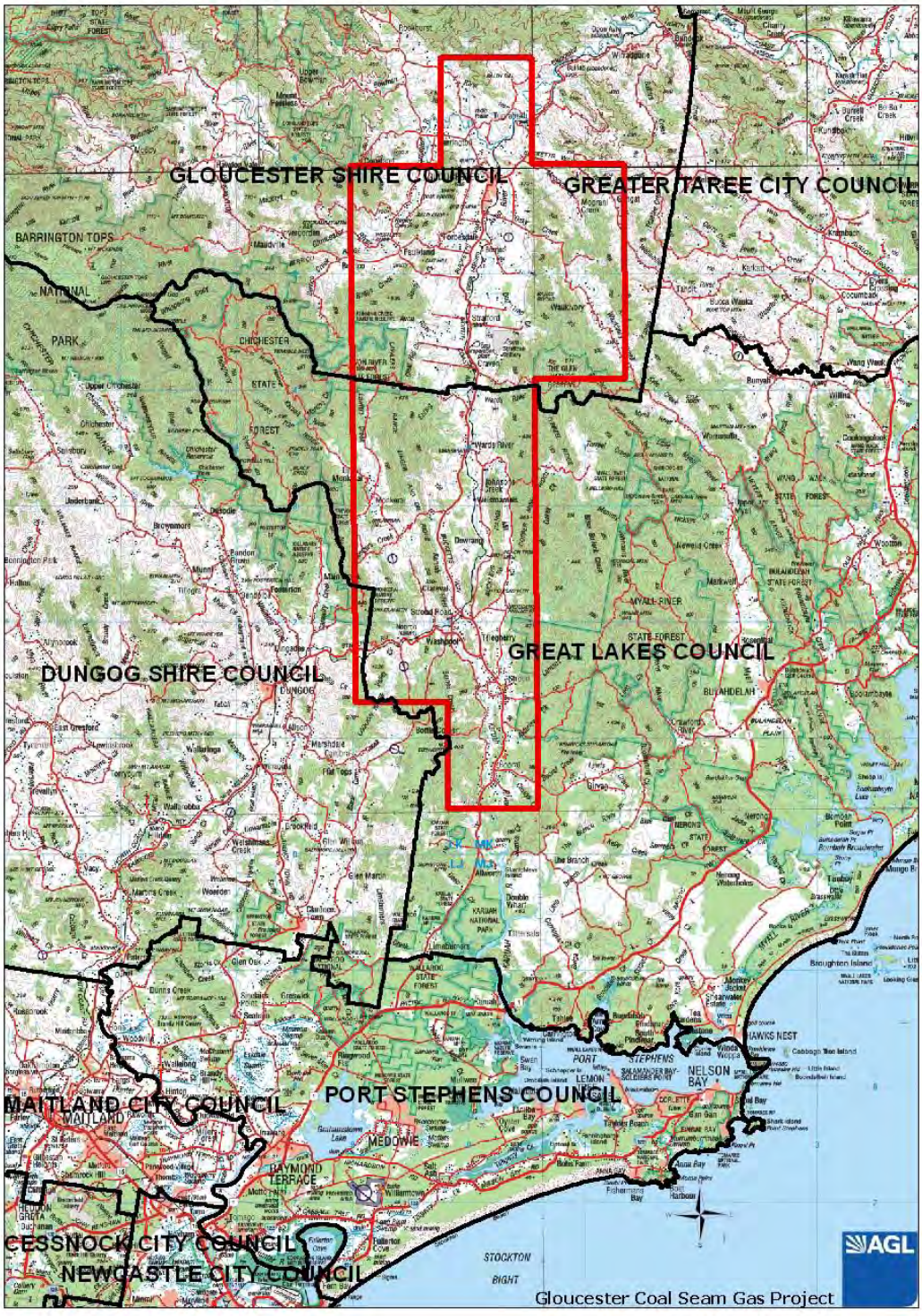

Figure 1– Project Area

2.2 Description of company activities

AGL is an ASX listed group and has been operating in Australia for 170 years and was one of its first listed companies. The company has activities in investing in sustainable energy businesses such as wind farms and innovative environmentally friendly projects such as the underground Bogong hydroelectric

power station in Victoria's High Country, and manages various coal bed methane assets, which include interests in permits in Queensland and NSW.

Coal seam gas (CSG) has developed rapidly in Australia over the last decade, emerging as a flexible, clean and competitive source of energy in an expanding economy seeking lower pollution fuels.

As extraction technology has developed and with the world increasingly carbon-conscious (coal seam gas produces approximately half the greenhouse gas emissions of coal) coal seam gas is seen as an increasingly valuable resource in Australia and abroad.

Extraction of coal seam gas differs from natural gas by targeting specific seams of coal, often at significant depths that make mining otherwise economically unviable. Removal of the gas is induced by reducing the hydrostatic pressure of water also contained in the coal seams. As the water is pumped out the reduction in pressure enables the flow of gas, which increases as the water level is reduced over time.

2.3 Scope

This EMP incorporates the environmental policies of AGL that are to underpin each activity the company takes in the exploration and development of coal seam methane prospects. AGL aims to meet, if not exceed best industry practice in environmental management associated with all its activities. This document has been produced in the framework of ISO 14001.

All subcontractors, consultants and suppliers working on any AGL project shall be bound to the requirements of the AGL Environmental Management Plan for that project, if they do not have in place a compliant Management System of their own.

3.0 OBJECTIVES & TARGETS

AGL aims to conduct its operations to the highest practicable level with regard to environmental protection and in accordance with all standards and regulation. AGL's environmental objectives include:

- To achieve a zero incident rate by good forward planning, implementation of environmental controls through training and awareness of all employees.

- To achieve compliance with all applicable regulatory requirements and other relevant industry standards and codes.

4.0 DEFINITIONS

For a full list of definitions, refer to **Environmental Management Systems – Specification with guidance for use** (Australia/New Zealand AS/NZS ISO 14001:2004) and **Occupational Health and Safety Management System**-AS/NZS 4801:2001).

5.0 ENVIRONMENTAL POLICY

a) AGL adheres to the AGL Health, Safety and Environment Policy, which has been developed with consideration for:

- The nature, scale and environmental impacts of the company's activities, products and services
- Prevention of pollution
- Statutory and other requirements
- Scope for continual improvement
- Providing a framework for setting and reviewing environmental objectives and targets

b) The Health, Safety and Environment Policy is communicated to all persons working for or on behalf of the organisation.

c) Top Management shall review this Policy at least annually.

6.0 PLANNING

6.1 Environmental Aspect Identification and Evaluation

AGL shall endeavour to minimise the impacts of its activities on the environment by identifying environmental hazards and putting into place controls to eliminate, where ever possible, any identified risk to the environment. Components of the environment to be considered include, but are not limited to:

- Water quality
- Marine environment
- Noise
- Air quality
- Visual quality
- Flora and fauna
- Heritage significance
- Surrounding community
- Vibration
- Natural resources

The Land and Approvals Manager and Operations Manager shall continually identify the environmental aspects of AGL's activities and develop safeguards/actions to mitigate the environmental impacts of these aspects. Resources for identifying a project's aspects include;

- EMP Status Plan,
- cross checked with Project Risk Assessments and
- JSEA record.

This information can then be used to formulate and revise the Project Environmental Management Plan, including a detailed environmental risk assessment and required actions to protect the environment. A register of

Activities, Aspects and Impacts has been developed as part of this process.

To determine those aspects that carry significant environmental risk, a risk assessment (as shown in Table 1) is used to rank the identified impacts. Environmental impacts are determined according to the:

- probability of occurrence; and
- severity of impact.

Likelihood	Minor	Important	Serious	Major	Catastrophic
Almost Certain	2.5 Moderate	5 High	7.5 High	20 Extreme	25 Extreme
Likely	2 Moderate	4 Moderate	6 High	16 Very High	20 Extreme
Possible	1.5 Low	3 Moderate	4.5 High	12 Very High	15 Very High
Unlikely	1 Low	2 Moderate	3 Moderate	8 High	10 Very High
Rare	0.5 Low	1 Low	1.5 Low	4 Moderate	5 High

Consequence

Table 1 - Risk matrix

The risk assessment enables AGL to prioritise and focus on those activities that present significant environmental risk to the organisation.

Table 2 summarises the activities, aspects and impacts along with the associated environmental risk.

Activity	Aspect	Impact	Likelihood	Severity	Consequence
All Activities	Vegetation clearing	Removal or damage to threatened or endangered species	Unlikely	Serious	Moderate
		Introduction of weed species	Likely	Important	Moderate
>Establishing drill pads & access tracks		Loss of visual amenity	Unlikely	Minor	Low
	Flora & Fauna	Removal of wildlife habitat	Likely	Important	Moderate
		Disturbance to local fauna	Likely	Important	Moderate
>Pond, sump & water storage construction	Soil & Erosion	Instability caused by earthworks	Likely	Serious	High
		Disruption to soil structure and horizons	Likely	Important	Moderate
		Runoff to local waterways	Possible	Major	Very High
>Drilling, perforation and fraccing		Contamination from hazardous materials	Possible	Major	Very High
	Noise	Heavy machinery movement for long durations	Almost Certain	Important	High
	Air	Dust creation from machinery and earthworks	Almost Certain	Important	High
>Pipeline and gathering line construction	Water	Runoff of sediment into local waterways	Possible	Serious	High
		Runoff of fuel and chemicals to surface and ground waters	Unlikely	Major	High
	Cultural Heritage	Disturbance of culturally sensitive sites	Possible	Serious	High
>Well operation	Waste	Inefficient resource use	Unlikely	Minor	Low
		Loss of visual amenity	Unlikely	Minor	Low
		Health risk	Unlikely	Minor	Low
	Bushfire	Personal safety	Rare	Major	Moderate
		Loss of property and wildlife habitat	Rare	Major	Moderate
	Community	Increased traffic	Almost Certain	Important	High
		Loss of amenity	Rare	Important	Low
Pond, sump & water storage construction	Flora & Fauna	Fauna falling into water sumps or storages	Unlikely	Serious	Moderate
	Soil & Erosion	Damage to soil structure from excavations	Almost Certain	Serious	High
		Enhanced risk of soil erosion	Almost Certain	Serious	High
	Water	Leaching of contaminated water into groundwater	Possible	Major	Very High
		Disposal of contaminated water	Almost Certain	Serious	High
Drilling, perforation and fraccing	Air	Dust or emission creation from heavy machinery	Likely	Important	Moderate
		Gas emissions from well	Likely	Critical	Moderate
	Noise	Increased noise nuisance from fraccing	Likely	Important	Moderate
	Soil & Erosion	Contamination from hazardous material spills	Likely	Serious	High
	Water	Contamination from hazardous material spills	Likely	Serious	High
Well operation	Air	Venting or release of greenhouse gases	Possible	Important	Low
	Soil & Erosion	Contamination of soils from inappropriate disposal of poor quality water	Possible	Important	Moderate
		Erosion caused by excess runoff from water disposal	Possible	Important	Moderate
	Water	Potential spill of poor quality water produced from wells to surface and ground	Possible	Serious	High

Table 2 – Register of Activities, Aspects and Impacts

6.2 Legal and Other Requirements

Environmental management for exploration activities throughout NSW is controlled largely by State Government legislation, although there is also applicable Commonwealth legislation which must be adhered to. AGL understands the importance of meeting its regulatory requirements, and therefore the Land & Approvals Manager will continually keep abreast of State and Federal legislation.

The current applicable legislation (outlined below) will be regularly reviewed and updated as required.

- Environment Protection and Biodiversity Conservation Act 1999 *(EPBC Act)*
- Environmental Planning and Assessment Act 1979 *(EPA)*
- State Environmental Planning Policy *(Major Projects)*
- SEPP(Infrastructure) 2007
- SEPP (Mining, Petroleum Production and Extractive Industries) 2007 *(SEPP (Mining))*
- SEPP 14 Coastal Wetlands *(SEPP 14)*
- SEPP 26 – Littoral Rainforests
- SEPP 33 – Hazardous and Offensive Industries
- SEPP 44 – Koala Habitat Protection

- SEPP - 71 Coastal Protection
- Pipelines Act 1967 *(Pipelines Act)*
- Petroleum (Onshore) Act 1991
- Water Act 1912 *(the Water Act)*
- Water Management Act 2000 *(WM Act)*
- Protection of the Environment Operations Act 1997 *(POEO Act)*
- Fisheries Management Act 1994 *(FM Act)*
- Roads Act 1993
- Native Vegetation Act 2003
- Heritage Act 1977
- Contaminated Land Management Act 1997
- Threatened Species Conservation Act 1995
- National Parks and Wildlife Act 1974
- Gloucester Local Environmental Plan
- Great Lakes Local Environmental Plan
- Australian Pipeline Industry Association Code of Environmental Practice

The AGL Environment Officer shall visit relevant Government department websites to ensure that this legislation is up to date, and shall advise personnel of changes and the impact on work activities. All environmental incidents must be recorded investigated and reported to project authority (including AGL Management) and or the appropriate local authority.

6.3 Objectives and Targets & Programmes

The AGL Gloucester Environmental Committee has set the objective of no breaches in compliance with statutory or other regulatory requirements. Therefore to achieve this, project specific objectives and targets have been set, taking into consideration the nature of activities, characteristics of the site, and the environmental aspects and impacts. These objectives and targets are included within the Environmental Management Procedures established for all key activities. Checklists are also in place to ensure procedures are followed.

The following procedures – included in Appendix 1 – have been developed to address identified activities and impacts:

- Produced Water Management
- Soil and Ground Stability
- Vegetation Management
- Bushfire Prevention
- Air Emissions
- Noise and Vibration
- Clearing and Grading
- Drilling, Perforation & Fraccing
- Pond Construction
- Trenching

- Cultural Heritage
- Community and Social Impact
- Waste Management
- Fuel and Chemical Storage and Spills
- Pipe stringing and welding
- Pipe laying and backfilling
- Hydrotesting
- Clean-up and Rehabilitation

The Project Environment Officer shall monitor, maintain records and report the progress made in achieving targets.

Objectives and targets shall be reviewed annually; however the following targets have been set as a minimum:

- Zero incident rate
- No breaches in compliance
- Participation in training, group meetings, environmental promotions, emergency drill and preparedness for control of potential environmental incident
- Effective management of subcontractors and project plant and equipment
- Effective implementation of safe work practices, risk analysis and risk controls
- Continual improvement in environmental performance
- Effective waste management and recycling

An Environmental Management Program has been developed to ensure all procedures are adhered to on an ongoing basis.

The Environmental Management Program includes the following information:

- Roles and responsibility
- What is to be monitored, frequency, methods for monitoring and storage of this information
- Targets and objectives
- Timeframes for achieving these objectives

The Environmental Management Program is to be reviewed at least annually, taking into consideration any changes in legislation, activities or the development of new technology.

7.0 IMPLEMENTATION AND OPERATION

7.1 Resources, Roles, Responsibility and Authority

Overall responsibility for the EMP lies with the Head of Land and Approvals. However, all staff and contractors are responsible for

undertaking activities in a way that minimises environmental impact with the aim of improving the company's environmental performance.

The organisational chart in Figure 2 outlines the key responsibilities attributed to AGL personnel involved in the development and implementation of the EMP. A description of the individual roles and responsibilities follows-:

- The Head of Land and Approvals has overall responsibility to ensure the EMP is implemented and is compliant according to the Environmental Policy. The Head of Land and Approvals will report to the Group General Manager.

- The Land and Approvals Manager is responsible for the development, implementation, monitoring and reporting in compliance with the operational components of the EMP, and Complaints Register. This includes the continuous improvement of environmental performance of people and equipment. This person reports to the General Manager.

- The Operations Manager is responsible for the daily operational requirements of site activities and associated facilities. This person will report to the General Manager.

A Project Environment Officer has been appointed to assist the Land and Approvals Manager and shall undertake the following-:

- Implement and monitor site or project specific plans
- Conduct Environmental Inductions for new employees
- Liaise with the Operations and the Land and Approvals Managers on environmental matters

Site staff shall carry out their duties as listed in their job descriptions in an environmentally responsible manner.

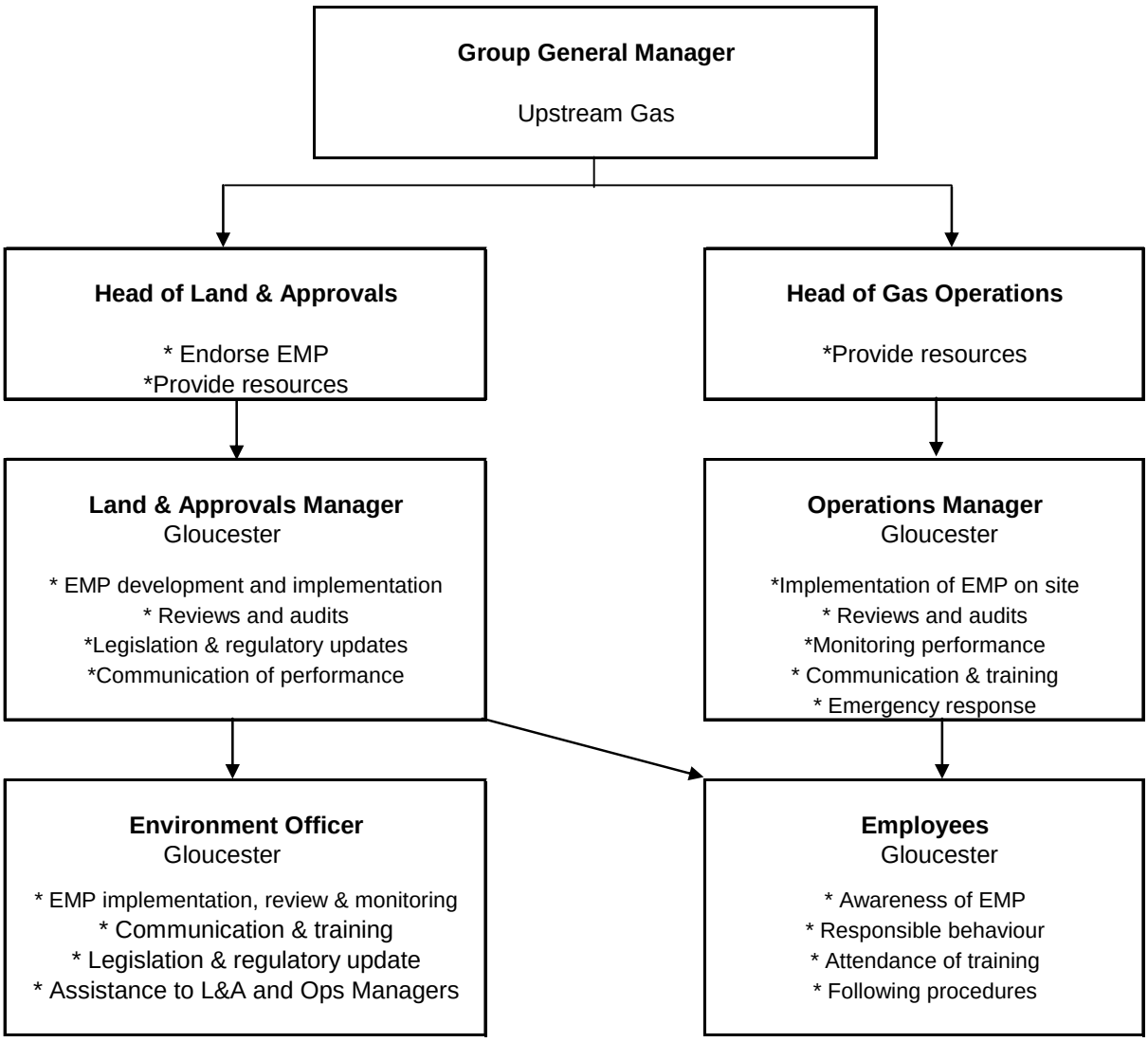

Figure 2 – Roles and Responsibilities

7.2 Competence, Training and Awareness

The authority for implementation and management of AGL Group environmental systems and controls is by competent people within the Group. Where circumstances demand, specialised skills and competencies will be employed.

New employees, project personnel and site visitors shall undergo a site induction.

Site inductions shall cover the following issues:

- Environmental aspects and impacts of the project
- Relevant legislation, permit conditions and other restrictions

- Compliance requirements and consequences of non-compliance
- Emergency procedures and contacts (covered in existing document)

Training and induction records for project personnel and visitors shall be kept on site, both electronically and on paper as Register of Plant & Equipment Licences, Site Induction Register and Site Visitors Register. Individual competencies for AGL employees and subcontractors will be regularly assessed by a competent environmental officer to ensure a high standard of environmental understanding.

Personnel selected to undertake tasks with the potential to cause significant environmental impact will not be deemed to be competent unless they have undergone the above training as a minimum.

7.3 Communication

The Land and Approvals Manager and Environment Officer shall be responsible for all environmental related communication, within AGL and with interested external parties and regulatory parties.

For project personnel, the location and access to sites shall be considered when deciding appropriate methods of communication.

Correspondence shall be documented in accordance with Data and Document Control.

7.4 Documentation

For details of all documentation contained within this EMP, refer to the appendix for an index.

All documents referenced in this EMP are contained in an Environmental Section within the Quality Folder on the project server.

7.5 Document Control

For control of documents refer to the procedure Data and Document Control / Project File System**.** Regular project weekly and/or monthly reporting of environmental status is required to ensure senior management is fully informed of environmental status of any project. Corporate systems will be reported on as a minimum annually or as legislation or other Government changes imply.

7.6 Emergency Preparedness and Response

An Emergency Response Procedure has been developed for the project to identify, prevent, mitigate and respond to accidents that are likely to have an environmental impact.

A Safety Management Plan has also been developed for the project to identify and mitigate against safety risks on site.

These procedures shall be reviewed with input from Project Managers and site personnel, at least annually or after the occurrence of an emergency event. Any changes to procedures must be approved by senior management.

Site Management shall display these plans in prominent locations around sites.

Site Management shall enlist local emergency response crews to carry out mock drills to test these procedures and the preparedness of site and emergency personnel.

8.0 CHECKING

8.1 Monitoring and measurement

The Environmental Monitoring Program details the procedures and timing for ongoing monitoring, review and revision of environmental management procedures.

All monitoring equipment shall be maintained as specified in the procedure for Inspection and Testing.

Refer to the Routine Environmental Monitoring Checklist and Site Inspection for a list of routine site environmental monitoring and inspection requirements.

Project Managers and Project Environment Officers shall identify project or site specific monitoring requirements, carry out a Hazard Identification and Risk Assessment, assign personnel to monitor and record this information, to track performance of operational and maintenance procedures, check for compliance with statutory or other requirements and targets and objectives and predict the likelihood of future corrective action.

8.2 Evaluation of Compliance

A review of applicable legislation shall be undertaken periodically to determine AGL's compliance with its applicable legal requirements.

A review of any industry standards or codes that are applicable to AGL's activities shall be undertaken periodically to determine AGL's compliance with those requirements to which it subscribes.
Records shall be kept of the above evaluations. Any deficiencies shall be recorded and corrective actions draw up and communicated to all affected personnel.

8.3 Non-conformance and Corrective and Preventative Action

Non conformances and corrective actions shall be dealt with as given in procedure Non Conformance**.**

8.4 Environmental Management Plan Audit

Internal Environmental Management Plan Audits shall be carried out in accordance with Internal Audit Procedures.

The Environmental Management Program will detail the timing of EMP audits, but at the minimum these should be conducted every three months.

External audits shall be conducted at least annually by suitably qualified auditors.

Any non-conformance or corrective action report shall be addressed as soon as practicably possible and be signed off during the completion of the next scheduled audit.

The results of audits shall be made available to all employees and AGL Management.

8.5 Management Review

To ensure continual improvement and effectiveness of the Environmental Management Plan, AGL Management shall participate in Management Reviews of the Plan at least annually.

Management reviews shall cover the following areas:

- Results of audits conducted;
- AGL's overall environmental performance;
- Frequency or recurrence of environmental incidents;
- Effectiveness of existing procedures (SWPs and JSEAs) for hazard identification, risk assessment and control;
- Changes in legislation, codes of practice or Australian Standards that may have an affect on compliance requirements and consequently existing risk control measures;
- Employee suggestions or recommendations;
- Any feedback from Government Agencies on environmental performance; and

- Recommendations for improvement of the Environmental Management System.

The details of Management Review meetings such as comments, observations and recommendations shall be documented.

Management shall assign responsibilities and timeframes for follow up action on recommendations to ensure these are implemented.

9.0 ASSOCIATED DOCUMENTS

AGL

* Safety Management Plan
* Emergency Response Procedure

OTHER

* AS/NZS ISO 14001:1996 Environmental Management Systems, *REVISED 2004* Environmental Management System – Specification with guidance for use (Australia/New Zealand AS/NZS ISO 14001: 2004)

'POEO' Protection of the Environment Operations Act 1997

APIA Environmental Policy and Code for Environmental Practice

State and Federal Occupation Health and Safety Legislation

NSW Government Environmental Management Systems Guidelines 1998

AS/NZS 4360:2004 Risk Management

ENVIRONMENTAL MANAGEMENT PLAN

Appendix 1 – Environmental Management Procedures

1. Produced Water Management	
Goals	To avoid potential impacts to quality of local ground and surface water systems and the surrounding environment
Responsibility	Operations Manager
Performance Objective	◗ To reuse at least 10% per year of the production water for agricultural purposes. ◗ To prevent contamination of watercourses and creeks, particularly with regard to salinity. ◗ To prevent contamination of surrounding soils, particularly with regard to salinity and sodicity. ◗ To minimise impact on riparian, aquatic and water dependant flora and fauna.
Mitigation Measures	◗ All produced water to be collected in localised storages. ◗ Storage ponds to be lined with a suitable polyurethane liner to prevent contamination of soil. ◗ Sufficient freeboard to allow for 1-in-100-year 72 hour rainfall event to be maintained in all storages. ◗ Production to cease when freeboard is exceeded until water can be appropriately disposed of. ◗ Water quality monitoring to be undertaken on an ongoing basis to inform disposal options. ◗ Disposal options to be discussed and agreed with relevant authorities. ◗ Comprehensive assessment of disposal options to be undertaken, giving preference wherever possible to beneficial use. ◗ Where irrigation using product water is approved, ongoing soil quality monitoring will be undertaken to assess any impacts on the local environment. ◗ Water quality monitoring to be undertaken prior to irrigation events.
Performance Measures	◗ Proportion of production water applied to beneficial use (eg irrigation). ◗ No uncontrolled release of produced water into the environment.
Monitoring / Auditing / Reporting	◗ Water quality monitoring to be conducted for each well (water quality monitoring procedures in place). ◗ Stored produced water to be quality monitored prior to release for agricultural purposes. ◗ Audits of produced water management procedures to be undertaken each three months, with implementation of any recommendations and corrective actions.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of audits and regular monitoring will be documented and incorporated into the EMP. Corrective actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ Engineering Design and Specifications for Produced Water Storages. ◗ Water Quality Monitoring Procedures. ◗ Produced Water Management Plan (under development).

2. Soil and Ground Stability	
Goals	To prevent project work areas, including well drill pads, pipeline alignments, surface water storages and access tracks, from becoming vulnerable to soil erosion.
Responsibility	Land and Approvals Manager
Performance Objective	To control and manage access to, and work at all site locations with the following objectives: ◗ to minimise the potential for soil erosion; ◗ to adequately prevent or control sediment release to land, waterways, and dams; ◗ to avoid unacceptable damage to native vegetation or wildlife habitats; ◗ to prevent impact on agricultural production or other legitimate land uses; ◗ to minimise the risk of the exposure of buried assets; ◗ to adequately control the subsidence of any subsurface earthworks; and ◗ to undertake all earthworks, including site remediation, such that soil horizons and structure are maintained as far as possible.
Mitigation Measures	◗ Sedimentation traps shall be installed where appropriate to prevent sedimentation runoff into waterways, dams, and agricultural land. ◗ Erosion control structures to be regularly inspected to ensure they are in good condition and operating effectively. ◗ If erosion is occurring due to inadequate vegetation, revegetation of the erosion area should be undertaken. Revegetation works should be conducted in consultation with the landowner and relevant authorities. ◗ Vehicular access should be restricted to stable ground where possible. Additional care should be taken near waterways and drainage lines, especially after rainfall. ◗ Restored ground should be routinely checked for subsidence and/or exposure, particularly at waterways and drainage lines and especially after flooding rains. If restoration is to occur, any imported soil will require landowner approval and shall be free of weeds and /or contamination. ◗ Drilling pad areas will be reduced to that required for operation once drilling and associated activities are complete. Sumps will be drained and the area surrounding the wellhead restored to its original condition. ◗ Earthen banks of above-ground water storages will be either lined with a geomembrane or planted with vegetation to avoid erosion and sediment runoff. ◗ The volume of produced water applied during any approved irrigation should be such that there is no risk of soil erosion. ◗ A monitoring program should be developed to monitor potential impacts associated with soil and ground stability.
Performance Measures	◗ Reduced soil erosion in highly susceptible areas. ◗ Reduced amounts of sediment discharge to land and watercourses. ◗ No impact to existing agricultural land or existing land uses.
Monitoring / Auditing / Reporting	◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions.

2. Soil and Ground Stability	
	◗ Inspections of all work sites should be undertaken on a regular basis, particularly following any major work. At the least, an audit of procedures will be undertaken every three months. ◗ Well pads should be inspected following establishment and again when any work is undertaken to increase or reduce the pad size. ◗ Areas prone to soil erosion should be inspected following significant rainfall.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	Erosion & Sediment Control ◗ Daily Site Environmental Controls Checklist ◗ Site Environmental Checklist

3. Vegetation Management	
Goals	To protect all work areas from soil erosion and to ensure the integrity of all wildlife habitats is maintained while protecting visual amenity
Responsibility	Land and Approvals Manager
Performance Objective	To control and manage work areas and access to all site areas with the following objectives: ◗ to promote and maintain stable vegetation cover; ◗ to minimise impact to native flora and fauna; ◗ to minimise soil erosion and sedimentation; ◗ to avoid losses to agricultural production; ◗ to reduce visual impacts; and ◗ to prevent and control weed invasions.
Mitigation Measures	◗ In areas of poor vegetation cover and where further impacts are likely, appropriate management measures shall be taken to ensure reseeding of these areas occurs. ◗ Regrowth trees within 3 metres of any trench centreline shall be removed to ensure tree roots do not pose a risk to pipeline integrity. ◗ Access tracks shall be maintained to ensure they remain navigable, including periodic reduction of regrowth. ◗ Areas where recent revegetation has taken place shall remain free of vehicles or machinery movement until such time that they are deemed suitable again for traffic. ◗ Appropriate flora species will be selected for revegetation, and suitable guidance will be sought and consultation undertaken to ensure this. ◗ Vegetation outside strictly delineated work areas – such as drill pads or a pipeline corridor – should not be disturbed. ◗ A monitoring program shall be developed to assess the success of revegetation. Further revegetation may be required where previous attempts are less than adequate.
Performance Measures	◗ Reduced soil erosion. ◗ No areas within the project area to be without adequate vegetation cover.
Monitoring / Auditing / Reporting	◗ Regular monitoring by patrol officers. ◗ Sites to be inspected regularly following revegetation until deemed successful. ◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of any recommendations and corrective actions.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Corrective actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ Site Environmental Checklist ◗ Weed Control Checklist ◗ ROW Clear and Grade Checklist

4. Weed Management	
Goals	To prevent the introduction and spread of Declared Plants and environmental weeds.
Responsibility	Land and Approvals Manager
Performance Objective	◗ No new weed species to be introduced into the area. ◗ The growth potential of existing noxious weeds in the project area should be minimised.
Mitigation Measures	◗ Pre Construction Procedures ◗ An inventory of noxious weed species occurring in the project area to be undertaken and appropriate weed control procedures to be developed based on regulatory pest plant control guidelines, regional weed control programs and an assessment of weed risk. ◗ Washdown and Hygiene Procedures ◗ All on-site personnel will follow the following weed hygiene procedures: o Prior to arrival at the project area, all vehicles, equipment and portable infrastructure (including trailers, generators, workshop and accommodation huts etc.) will be washed down (spray-cleaned). o Cleaning procedures need to remove soil and organic matter from the surfaces of vehicles, equipment and portable infrastructure, including undercarriage and running gear. o Proof of inspection, such as “washdown tickets” from state operated facilities, is required for all vehicles coming from known area of infestation, before permission is granted to enter uninfected tenure areas. If the vehicle is not considered clean by a trained weed inspector, it shall be re-washed and re-inspected before certification. o A weed washdown sticker (coloured yellow) is to be placed on the windscreen of vehicles that have been certified weed free. o Vehicles and machinery certified weed free shall be noted in the Weed Register to be updated regularly and located at the Site Office. ◗ Liaise with Local Councils and other authorities for specific weed data sets. ◗ Only approved access tracks and roads are to be used for access to the project area. ◗ Appropriate training of all personnel. ◗ Superintendents and supervisors will be briefed on the recognition of noxious weeds.
Performance Measures	◗ During construction, regular field inspections for the presence of weeds will be undertaken, particularly in problem areas, and weed control carried out as determined by the land and Approvals Manager in consultation with Environmental Authorities. ◗ It will be the responsibility of the Operations Manager to ensure that proper weed management controls have been undertaken.
Monitoring / Auditing / Reporting	◗ Regular monitoring by patrol officers. ◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of any recommendations and corrective actions. ◗ Any introduction of declared flora or other environmental weeds will be reported to the Land and Approvals Manager who will notify relevant

4. Weed Management	
	authorities.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Corrective actions shall be closed out by senior management according to an agreed responsibility and timescale. ◗ If a substantial outbreak of a declared noxious weed is found in the project area, the following will be implemented: o Vehicle movement through the area will be immediately halted. o The Operations Manager will be notified as soon as practicable and in turn will notify relevant Local Council of the location of the weed problem. In addition, the local Land Protection Officer and the Administering Authority shall also be notified. o The area will be assessed and treated, if necessary, by hand pulling individual plants or by boom or spot spraying, before any earth moving equipment or machinery enters the area. Under no circumstances will the plants found be chopped slashed or burned due to the potential for spreading seeds. o Any vehicle leaving the affected area will be rewashed and inspected. The vehicle will then obtain a new certification sticker with a new register number and date of inspection.
Associated Documents	◗ Weed Control

5. Bushfire Prevention	
Goals	To prevent the cause of bushfire as a result of operational activities.
Responsibility	Operations Manager
Performance Objective	◗ To minimise the risk of bushfire; ◗ To protect the public and personnel; ◗ To protect property and minimise damage or loss; ◗ To protect flora, fauna and habitats; ◗ To prevent the spread of bushfire in the event of ignition; and ◗ To provide adequate response in the event of ignition.
Mitigation Measures	Implement measures to prevent and respond to bushfire incidents that are in accordance with the following-: ◗ AS2885.3 ◗ Safety and Emergency Plans ◗ Bushfire management plans which include prevention, preparedness, emergency contacts, equipment, response and training. ◗ Project activities should adhere to regulatory and local fire authority guidelines and comply with fire restrictions, notification requirements and permitting procedures. ◗ All vehicles shall be equipped with appropriate vehicle fire extinguishers. ◗ Firebreaks are to be installed around facilities. ◗ Regular checks to ensure there is no build up of debris or vegetation matter that could cause an ignition. ◗ Where combustible or flammable chemicals are required to be stored on site, appropriate fire fighting equipment shall be available. Incompatible chemicals should not be stored together, and where possible, flammable liquids should be stored in a flammable liquids cabinet.
Performance Measures	◗ No outbreaks of bushfire as a result of project activities.
Monitoring / Auditing / Reporting	◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of a bushfire are to be documented and incorporated within this EMP. Corrective actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ AS2885.3 ◗ Safety Management Plan ◗ Emergency Response Plan

6. Air Emissions	
Goals	To minimise the release of air pollutants.
Responsibility	Operations Manager
Performance Objective	◗ To minimise atmospheric emissions; ◗ To minimise greenhouse gas emissions; ◗ To minimise the creation of safety hazards; and ◗ To minimise disturbance to the community.
Mitigation Measures	**GAS** ◗ The venting of coal seam methane gas from site infrastructure shall be minimised. ◗ The flaring of gas from production wells shall be limited to that necessary as part of the production evaluation process, following which flaring will be halted. ◗ Flaring is recognised as preferable to venting of coal seam methane gas, as the associated greenhouse gas emissions are reduced by a factor of more than 20. ◗ Where possible, planned venting of gas shall be conducted under favorable meteorological conditions to help assist rapid dispersion of the gas. ◗ Leak detection surveys shall be periodically performed along any pipeline as per AS2885.3 requirements. ◗ Where gas is to be released to the atmosphere, it should be flared wherever technically and economically feasible. ◗ Gas vent areas are to be located in accordance with regulatory and relevant Australian Standard requirements. ◗ Consultation with nearby residents and local authorities shall be undertaken prior to any major venting exercise. **DUST** ◗ To minimise dust problems in the project area the following mitigation measures should be adopted as appropriate-: ◗ revegetate with existing species and restrict access until the vegetation is established; ◗ ensure designated speed limits are being observed and are appropriate; ◗ minimise vehicular movement; ◗ utilise geotextiles, hessian, mulched vegetation to help settle high dust areas; and ◗ Use dust suppression water where appropriate and available. ◗ Areas impacted by heavy bulldust should be stripped and the subsurface watered to provided a firmer base.
Performance Measures	◗ Zero complaints from local residents or regulatory authorities.
Monitoring / Auditing / Reporting	◗ Monitoring will be on a regular basis during inspections by patrol officers. ◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions.

6. Air Emissions	
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Corrective actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ AS2885.3 ◗ Dust Control

7. Cultural Heritage	
Goals	To avoid impact on sites which have heritage or cultural value.
Responsibility	Land and Approvals Manager
Performance Objective	◗ To avoid impact to known sites or sites discovered within or near the project area. ◗ To implement an effective consultation program with traditional landowners, community groups, regulatory authorities, and other relevant stakeholders.
Mitigation Measures	◗ The inventory of heritage sites compiled for the Cultural Heritage Management Plan shall be referred to prior to any maintenance or construction activity. ◗ Heritage sites within or close to project areas shall be adequately marked or barricaded off to ensure they are not disturbed. ◗ Patrol officers and field operations staff shall be adequately trained in Cultural and Heritage issues and management. ◗ A consultation program shall be implemented to help facilitate discussions between traditional owners, community groups, regulatory authorities, and relevant stakeholders.
Performance Measures	◗ Zero complaints from traditional owners, regulatory authorities, community groups or relevant stakeholders. ◗ No disturbance to heritage or cultural sites.
Monitoring / Auditing / Reporting	◗ Monitoring during construction, operation or maintenance activities. ◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ Regulatory legislation. ◗ Project Environmental Assessments (detail heritage locations from database searches).

8. Community and Social Impact	
Goals	To foster positive relationships with local communities and avoid negative impacts, including on visual amenity, traffic and local businesses.
Responsibility	Land and Approvals Manager
Performance Objective	◗ To engage interested parties in consultation at all stages. ◗ To manage vehicle traffic to minimise disruption to local traffic flows. ◗ To use local suppliers and businesses wherever possible. ◗ Design permanent infrastructure such that there is no impact on visual amenity.
Mitigation Measures	◗ Development of relationships with local interest groups. ◗ Implementation of a stakeholder consultation plan. ◗ Minimising vehicle movements, particularly on routes of high flow or at peak times. ◗ Using local suppliers and businesses wherever possible. ◗ Planning and designing permanent infrastructure with consideration for existing visual amenity.
Performance Measures	◗ Regular presentations to local councils and interest groups to update community on project progress. ◗ Zero complaints from local residents about traffic disruptions. ◗ No loss of visual amenity.
Monitoring / Auditing / Reporting	◗ Monitoring of community relationship by Land and Approvals Manager, including consideration of ways in which consultation with all interest groups can be improved. ◗ Reporting of all complaints and community consultation.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of any complaints will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ Stakeholder Consultation Plan (under development).

9. Waste Management	
Goals	To operate more efficiently and thereby reduce waste outputs; to recycle and reuse materials where possible; and to dispose of waste materials appropriately.
Responsibility	Operations Manager
Performance Objective	◗ To avoid the contamination of soil and water; ◗ To minimise potential health risks to workers and the public; ◗ To minimise adverse effects on native vegetation and wildlife.
Mitigation Measures	◗ Development and implementation of detailed waste management procedures. ◗ Management measures for solid waste materials such as timber, pallets, drums, plastic, glass, metal and rubber to include: ▪ stockpiling reusable and recyclable materials such as pallets, timber skids, drums, and scrap metals; ▪ installation of designated bins at all sites for aluminium cans, glass, and paper; and ▪ disposal of general refuse at approved local authority landfill sites. ◗ Disposal of hazardous wastes such as waste oils or chemicals shall be in accordance with the relevant regulatory requirement. Management measures should include-: ▪ provision of a designated safe storage area for wastes prior to their collection and transport to an offsite facility for either reuse, recycling, treatment, or disposal. The facility is to be approved by the relevant local authority; and ▪ appropriate design measures for storage areas to prevent any spills to the local environment. ◗ Sewerage disposal should be either an approved septic system or mobile chemical treatment systems. ◗ Management procedures for the disposal of general refuse, such as food scraps, domestic garbage, and commercial waste, should include-: ▪ collection and transport to an approved local authority landfill site; ▪ on site disposal at camp or work sites should only be considered for remote sites, providing approval from the relevant local authority has been granted or if storage of the refuse poses a health risk; ▪ site facilities to be maintained to an orderly and hygienic standard; and ▪ litter bins to be provided at all sites and regular site maintenance to be conducted to ensure litter accumulation is avoided.
Performance Measures	◗ Re-use and recycling program being maintained. ◗ Site facilities are kept clean.
Monitoring / Auditing /	◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations

9. Waste Management	
Reporting	and corrective actions. ◗ Monitoring on a regular basis by all staff.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ Waste Minimisation & Disposal ◗ Waste Management Checklist

10. Fuel and Chemical Storage and Spills	
Goals	To minimise risk of a fuel or chemical spill and minimise environmental impacts should a spill occur.
Responsibility	Operations Manager
Performance Objective	◗ To avoid any fuel or chemical spills; ◗ To avoid unacceptable safety hazards; ◗ To prevent the contamination of soil and water; and ◗ To minimise atmospheric emissions.
Mitigation Measures	◗ The storage and handling of fuels and chemicals shall be in accordance with AS 1940:1993 – *The storage and handling of flammable and combustible materials* and relevant legislation. ◗ When purchasing chemicals, the material safety data sheets (MSDS) should also be obtained and made available on site to personnel. Personnel handling chemicals shall be appropriately trained and provided with the necessary personal protective equipment. ◗ Chemical use should be minimised and only a practicable amount of chemicals shall be stored on site. ◗ Appropriate design measures for storage areas, such as bunding and grease traps, to be employed to prevent any spills from being released into the local environment. ◗ Appropriate handling procedures for fuels and chemicals should be developed to help prevent spills to the local environment. ◗ Fuels and chemicals should not be stored or handled in the vicinity of waterways or creeks where possible. ◗ Workforce training shall be provided for fuel and chemical handling and spill response and recovery procedures.
Performance Measures	◗ Zero fuel or chemical spills to the local environment.
Monitoring / Auditing / Reporting	◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions. ◗ Monitoring on a regular basis by all staff.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ AS 1940:1993 – *The storage and handling of flammable and combustible materials* ◗ Control of Hazardous Substances (General) ◗ Control of Hazardous Substances (Solvents & Flammables)

11. Noise and Vibration	
Goals	To ensure that noise from well construction and operation is within acceptable limits at adjacent residential premises and other noise sensitive receptors.
Responsibility	Operations Manager
Performance Objective	◗ Minimise the level and time of noise disturbance.
Mitigation Measures	◗ Local residents shall receive adequate notice of potential noise incursions. ◗ Heavy traffic use of local roads will be restricted to the hours of 6 am to 6 pm Monday to Saturday. ◗ Construction camp stores and stockpiles shall be located as far as possible from noise sensitive areas. ◗ Where practicable, excessively noisy construction activities (fraccing) shall be scheduled for periods which are less likely to result in a noise nuisance. ◗ Construction equipment shall be equipped with appropriate noise abatement devices. ◗ Noise generating equipment shall be located at appropriate distances from residences and/or will be enclosed or screened if necessary. ◗ Noise Abatement procedures will be undertaken in accordance with Section 3 of the EPP Noise 1997. ◗ If required, blasting shall be undertaken in accordance with criteria for reasonable noise from Schedule 2 of the EPP Noise 1997.
Performance Measures	◗ Zero noise related complaints received during construction.
Monitoring / Auditing / Reporting	◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions. ◗ In response to noise complaints, noise monitoring will be undertaken at locations close to where the activities are occurring.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale. ◗ Complaints received about noise and will be investigated within 24 hours and, if required, operating activities will be modified to reduce noise impacts.
Associated Documents	◗ Noise Control

12. Clearing and Grading	
Goals	To ensure successful vegetation rehabilitation through topsoil management and to minimise the impact to ecological communities from the clearing of vegetation.
Responsibility	Operations Manager
Performance Objective	◗ Minimise disturbance of flora and fauna habitats. ◗ Avoid adverse impacts on cultural and heritage sites. ◗ Optimise the success of vegetation rehabilitation. ◗ Minimise soil erosion and degradation. ◗ Minimise the risk of weeds spreading. ◗ Minimise impact on visual amenity. ◗ Minimise modification to surface water flows (drainage lines) and water quality. ◗ Minimise disruption to landholders and third parties. ◗ Minimise erosion due to disturbance of sodic soils.
Mitigation Measures	◗ Conduct searches of the EPA Contaminated Sites Register prior to construction. ◗ Known EPA Contaminated Sites to be avoided. ◗ No clearing outside of designated well and pipeline construction areas. ◗ No clearing of remnant vegetation or protected species for access tracks or temporary work space. ◗ Reduction in clearing through sensitive environments will be marked clearly on alignment sheets and in the field. ◗ Permits must be obtained prior to any clearing being conducted. ◗ Cleared vegetation will be stored (not burnt) for respreading during re-instatement. ◗ Cleared vegetation or soil is not to be pushed up against trees or stored against fencelines. ◗ Erosion control measures will be installed where appropriate to minimise topsoil loss. ◗ Topsoil depth removal will be typically be 20 – 30 cm. In areas of agricultural cropping this will be increased to 40 - 50 cm. ◗ Topsoil will be stored above the potential floodline, particularly at water courses and known flooding areas. ◗ Special consideration will be given to the handling of sodic soils to ensure that they are exposed for as short a time as practicable to minimise potential erosion impacts.
Performance Measures	◗ Topsoil and vegetation to be removed and stored appropriately to allow for successful reinstatement. ◗ No damage to flora and fauna from unapproved or unplanned vegetation clearing. ◗ Erosion control measures installed during clear and grade.
Monitoring / Auditing / Reporting	◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions.

12. Clearing and Grading	
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ Right of Way Clearing & Grading

13. Drilling, Perforation and Fraccing	
Goals	To avoid impacts on the local environment, including on vegetation, soils and surface and ground water, from drilling and associated activities; and to minimise associated noise impacts and air emissions.
Responsibility	Operations Manager
Performance Objective	◗ Minimise disturbance of flora and fauna habitats. ◗ Minimise noise impacts during well construction. ◗ Minimise impacts on local soil environment from vehicle movement and pad construction. ◗ Minimise impacts on local surface waters associated with well construction. ◗ Minimise risk of contamination of groundwater.
Mitigation Measures	◗ Observance of all relevant Procedures as described above to minimise risks associated with erosion and soil stability, ground and surface water contamination, noise impacts, air emissions, waste and fuel and chemical management, and vegetation and weed management, ◗ Observance of detailed Drilling and Testing EMP, which is to be available in the Site Office.
Performance Measures	◗ Zero complaints relating to noise from local residences. ◗ No contamination of surface or ground water, or local soil environments. ◗ Successful restoration of drill pads at completion of construction activities.
Monitoring / Auditing / Reporting	◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ Drilling and Testing EMP

14. Pond Construction	
Goals	To avoid impacts on the local environment, including on vegetation, soils and surface and ground water, from construction of produced water storages.
Responsibility	Operations Manager
Performance Objective	◗ Minimise impacts associated with construction of produced water ("turkey's nest") storages.
Mitigation Measures	◗ Observance of all relevant EMPs as described above to minimise risks associated with erosion and soil stability, ground and surface water contamination, noise impacts, air emissions, waste and fuel and chemical management, and vegetation and weed management, ◗ Design and construction of storages based on engineering specifications to minimise environmental impacts, including: ▪ storage capacity to take into consideration probable water production rate as well as climate conditions, in order to minimise risk of spillage; ▪ installation of geomembrane liner to eliminate leaching; ▪ inclusion of spillway to facilitate safe spillage during exceptional conditions; ▪ operational guidelines to minimise risk of spillage; and ▪ cut-and-fill construction techniques to avoid the need to import soil from other sites.
Performance Measures	◗ No soil erosion or air emissions. ◗ No contamination of surface or ground water, or local soil environments. ◗ Successful operation of water storages such that there are no spills to the environment.
Monitoring / Auditing / Reporting	◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ Conceptual Design and Specifications for Produced Water Storages.

15. Trenching	
Goals	To reduce the impact of trenching on the topsoil quality, native fauna, domestic stock and agricultural production of the land.
Responsibility	Operations Manager
Performance Objective	◗ Minimise risk of topsoil and subsoil mixing. ◗ Successful rehabilitation of native vegetation and agricultural cropping. ◗ Minimise disruption to landholders and other stakeholders. ◗ Avoid damage to third party buried infrastructure.
Mitigation Measures	◗ Trenching is to be undertaken as per agreed specifications. ◗ Third Party infrastructure will be identified and accurately shown on alignment sheets and marked in the field prior to trenching. ◗ Trenching Supervisor and Superintendent will be instructed of the procedure if a previously unidentified contaminated site is uncovered during construction. This includes: – Stopping trenching at the location; – Relocation and starting trenching 50 m ahead; – Advising the Operations Manager and Land and Approvals Manager; – Instigating site assessment according to EPA; – Instigating actions according to the assessment. This may include remediation of the site or movement of the pipeline alignment to avoid the site. ◗ Trench spoil (subsoil) is to be separated from the topsoil. ◗ Subsoil will be stored above the potential floodline, particularly at water courses and known flooding areas. Erosion control measures will be installed where appropriate to minimise erosion risk. ◗ All major roads will be bored. ◗ If an open cut crossing of a road or track is necessary, consultation will be undertaken with landholders and third parties. Detours and signage will be installed as required. ◗ Where appropriate, gaps in the topsoil will be provided, and subsoil and vegetation stockpiled to assist the movement of livestock and native fauna. ◗ Where appropriate, gaps in soil stockpiles and resultant backfill mounds will be provided to mitigate the potential impact of overland flow that is not parallel to the backfill mounds. ◗ The trench will be left open for the minimum period practical. It will not be left open for extended periods on slopes leading to a watercourse or drainage line. ◗ Native fauna ramps shall be installed at the ends of trenching (at least every 1 km), and at each normal break e.g. road and water crossing.
Performance Measures	◗ Disruption to landholders and third parties to be minimised. ◗ Trench spoil (subsoil) and topsoil to be separated. ◗ Trench plugs and erosion mitigation measures implemented to reduce the risk of erosion. ◗ Ramps to be installed at trench breaks and appropriate locations.
Monitoring / Auditing /	◗ During construction, the work areas will be regularly inspected to assess the implementation of the construction mitigation management

15. Trenching	
Reporting	procedure. ◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ Trenching ◗ Road Crossings Open Cut

16. Pipe Stringing and Welding	
Goals	To reduce the impact of stringing and welding on landholders and the environment.
Responsibility	Operations Manager
Performance Objective	◗ Minimise the disturbance to landholders and third parties. ◗ Minimise the risk of bushfire. ◗ Ensure that native fauna and livestock have access across the pipeline.
Mitigation Measures	◗ Trucks delivering pipe shall be scheduled during daylight hours and along designated access roads to minimise noise and dust impacts. ◗ All pipeline packaging and welding waste shall be removed from site to an approved disposal facility. ◗ When the pipe is strung, ensure gaps are left to allow access for native fauna and livestock. The gaps shall be aligned with access tracks, stored vegetation and topsoil, fences and gates. ◗ Pipeline caps shall be placed over the ends of the pipe to prevent dust and wildlife from getting in. ◗ During welding, the following pre-cautions will minimise the risk of starting bushfires: – Working area shall be cleared of vegetation; – Welding trucks shall be equipped with a fire fighting unit with adequate water storage capacity and fire extinguishers. Welding crews shall be trained in the use of the fire fighting equipment; and – Water trucks (used for dust suppression) shall be available with water storage capacity in the event of a fire.
Performance Measures	◗ Disruption to landholders and third parties is minimised. ◗ Native fauna and livestock have areas where they can cross the easement. ◗ No uncontrolled fires to be started.
Monitoring / Auditing / Reporting	◗ During construction, the work areas will be regularly inspected to access the implementation of construction mitigation management procedures. ◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ Pipeline Stringing & Welding

17. Pipe laying and Backfilling	
Goals	To reduce the impact of pipe laying and backfilling on the environment.
Responsibility	Operations Manager
Performance Objective	◗ Minimise the disturbance to landholders and third parties. ◗ Minimise the risk of topsoil and subsoil mixing. ◗ Ensure that native fauna and livestock have access across the pipeline.
Mitigation Measures	◗ Erosion berms will be constructed on slopes to divert rainfall away from the alignment. ◗ Compaction over the working area will be ripped prior to re-spreading of topsoil. ◗ Trench plugs to be provided and backfilled soils compacted along the trench to prevent erosion along backfilled trench. ◗ A small crown shall be left over the backfilled trench to allow for settling. Breaks of the crown shall be provided to allow for water flow across the alignment at regular points. These breaks shall be determined using the overland flowpaths developed by the relevant authority. ◗ Pipeline markers will be installed according to land use to locate the pipeline. ◗ Topsoil will only be respread over the working area following the backfilling of all subsoil. Topsoil will not be used as padding material. ◗ In areas of particularly sodic soil, special precautions will be taken to ensure that topsoil and sodic subsoil is not mixed. In addition, these areas will be backfilled at a quicker rate to ensure minimal exposure time for highly erodible soils. Sodic soils will be placed at the base of the trench to further limit exposure. ◗ Obvious low-lying floodways will be identified during the pipeline route survey process to identify those areas requiring a management of floodway strategy to be developed and applied in order to mitigate potential erosion impacts. ◗ At the start of each day, any exposed trench shall be inspected for the presence of wildlife and, if found, it should be appropriately removed. ◗ The ends of exposed pipe shall be sealed at the end of each day. ◗ At the end of each day, no extensive lengths of trench shall be left exposed.
Performance Measures	◗ Subsoil returned to the trench prior to topsoil. ◗ Appropriate erosion berms to be installed on sloped areas.
Monitoring / Auditing / Reporting	◗ During construction, the work areas will be regularly inspected to access the implementation of construction mitigation management procedures. ◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ Pipeline Laying & Backfilling ◗ Backfill & Reinstatement Gas Pipelines

18. Hydrotesting	
Goals	To minimise all impacts associated with hydrostatic testing on the surrounding soil and water environments.
Responsibility	Operations Manager
Performance Objective	◗ Minimise impacts to soils, groundwater and general water quality. ◗ Minimise the amount of water used. ◗ Minimise the risk of soil erosion.
Mitigation Measures	◗ If water quality is sufficient, water will be sourced from existing storages within the production field. ◗ If another source of water is required, it shall be approved in advance by the Environment and Land Manager. ◗ All permits to source water shall be approved in advance. ◗ Biodegradable biocides shall be selected where possible. ◗ Ensure there is no damage from discharge of the water. ◗ All additional approvals from landholders and for water disposal options. ◗ Where sufficient water is not available it will be trucked in as required. ◗ Water quality testing procedures and values will be approved prior to discharge by the Environment and Land Manager. ◗ Prior to discharge, the Land and Approvals Manager shall be consulted about the water quality and testing required, and consult with Council and relevant authorities. ◗ Discharge hydrotest water to land to avoid runoff to creeks, agricultural drainage lines, erosion or flooding. At the discharge point materials shall be used to reduce the force and to dissipate the water to avoid soil erosion.
Performance Measures	◗ Testing Procedures will be in accordance with AS 2885. ◗ Discharge will be within all regulatory and landholder requirements.
Monitoring / Auditing / Reporting	◗ Monitor test water discharges from the site to ensure compliance with water standards. ◗ During construction, the work areas will be regularly inspected to access the implementation of construction mitigation management procedures. ◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions.
Corrective Action	◗ Should the disposal of hydro-test waters fail to meet the performance criteria the Construction Contractor will review disposal options. ◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale.
Associated Documents	◗ Pipeline Testing & Commissioning

19. Clean Up and Rehabilitation	
Goals	To rehabilitate all disturbed areas to a land use capability compatible with the surrounding land use. Any rehabilitation will utilise all actable methods to ensure that a stable land form is reinstated.
Responsibility	Land and Approvals Manager
Performance Objective	◗ Minimise loss of vegetation and habitat; ◗ Minimise erosion and sediment runoff; ◗ Minimise the risk of subsidence; ◗ Minimise the loss of visual amenity; ◗ Minimise the modification of drainage patterns; and ◗ Minimise the damage to any infrastructure.
Mitigation Measures	◗ Minor surface roughness will be encouraged when spreading topsoil to trap water and seed. ◗ Other cleared vegetation will be removed and disposed of in consultation with the appropriate landholder or respread over cleared areas to assist in seed distribution and provide shelter for fauna. ◗ Areas affected by operations and development will be re-profiled to original and stable contours, re-establishing surface drainage lines and other land features. ◗ Erosion and sediment controls will be installed if necessary. Existing soil erosion measures will be reinstated to a condition at least equal to the pre-existing state. ◗ Above-ground infrastructure shall be fenced to discourage third party, stock and wildlife entry. ◗ Signs, fences or other barriers shall be installed where appropriate to prevent unauthorised easement access. ◗ Permanent pipeline warning signs shall be erected along easements. ◗ In general, revegetation will occur through the re-spreading of cleared topsoil and vegetation. Active revegetation will only occur where stabilisation is required to prevent erosion. ◗ Where active revegetation is required, local native species will be selected in preference to introduced. ◗ In other areas where seeding or replanting is required, the seed mix will be agreed with the relevant land holder. ◗ Environmental features such as rocks and dead timber will be replaced in cleared areas as appropriate. ◗ Trees will be permitted to grow within 3m of the pipeline as long as: – pipeline integrity is not affected; – regrowth is considered; and – signage remains visible.
Performance Measures	◗ Land and infrastructure affected by the planning, construction and post construction phases will be restored to pre-disturbance status or better. ◗ No new weed species to be introduced. ◗ Revegetation shall return areas to similar composition as surrounding vegetation. ◗ Drainage patterns returned following construction.

19. Clean Up and Rehabilitation	
Monitoring / Auditing / Reporting	◗ Audits will be conducted in accordance with the Environmental Management Program, with implementation of the recommendations and corrective actions. ◗ Monitoring on a regular basis by all staff.
Corrective Action	◗ Investigations/corrective actions undertaken as a result of the audit or regular monitoring will be documented and incorporated into this EMP. Correction actions shall be closed out by senior management according to an agreed responsibility and timescale. ◗ Investigate complaints and take all steps to restore area according to land holder requirements.
Associated Documents	◗ Site Clean Up & Clearance ◗ Pipeline Clean Up & Rehabilitation

Appendix E

Material safety data sheets

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AMC XAN-BORE

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AMC XAN-BORE

PRODUCT USE
Drilling fluids compound; drilling viscosifier.

SUPPLIER

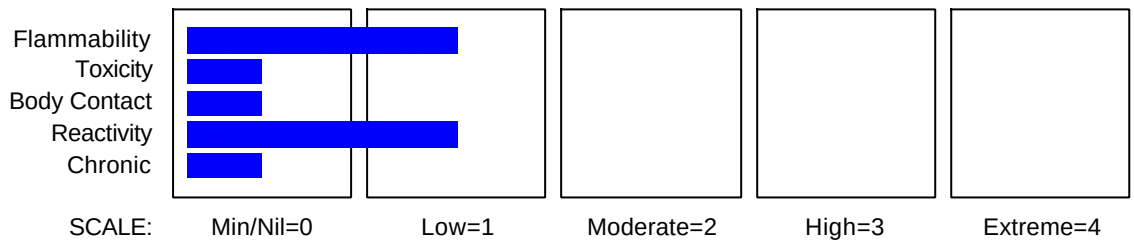
Company: AMC
Address:
5 Pitino Court
Osborne Park
WA, 6017
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Company: AMC
Address:
PO Box 1141
Osborne Park
WA, 6916
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



RISK
•None under normal operating conditions.

SAFETY
•None under normal operating conditions.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
gum xanthan	11138-66-2	100

Section 4 - FIRST AID MEASURES

SWALLOWED
• If swallowed do NOT induce vomiting.
• If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

continued...

• Observe the patient carefully.
• Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

EYE
■ If this product comes in contact with the eyes:
• Wash out immediately with fresh running water.
• Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
• Seek medical attention without delay; if pain persists or recurs seek medical attention.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin or hair contact occurs:
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED
• If dust is inhaled, remove from contaminated area.
• Encourage patient to blow nose to ensure clear passage of breathing.
• If irritation or discomfort persists seek medical attention.

NOTES TO PHYSICIAN
■ Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• There is no restriction on the type of extinguisher which may be used.
• Use extinguishing media suitable for surrounding area.

FIRE FIGHTING
• Alert Fire Brigade and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves for fire only.
• Prevent, by any means available, spillage from entering drains or water courses.
• Use fire fighting procedures suitable for surrounding area.

FIRE/EXPLOSION HAZARD
• Solid which exhibits difficult combustion or is difficult to ignite.
• Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion.
• Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust (420 micron or less) may burn rapidly and fiercely if ignited; once initiated larger particles up to 1400 microns diameter will contribute to the propagation of an explosion.
• A dust explosion may release of large quantities of gaseous products; this in turn creates a subsequent pressure rise of explosive force capable of damaging plant and buildings and injuring people.
Combustion products include: carbon monoxide (CO), carbon dioxide (CO_2), other pyrolysis products typical of burning organic material.

FIRE INCOMPATIBILITY
• Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.

HAZCHEM
None

PERSONAL PROTECTION

Glasses:	Gloves:	Respirator:
Chemical goggles.	When handling larger quantities:	Particulate

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
• Clean up all spills immediately.
• Avoid contact with skin and eyes.
• Wear impervious gloves and safety glasses.
• Use dry clean up procedures and avoid generating dust.

continued...

MAJOR SPILLS
• Clear area of personnel and move upwind.
• Alert Fire Brigade and tell them location and nature of hazard.
• Control personal contact by using protective equipment and dust respirator.
• Prevent spillage from entering drains, sewers or water courses.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Limit all unnecessary personal contact.
• Wear protective clothing when risk of exposure occurs.
• Use in a well-ventilated area.
• Avoid contact with incompatible materials.
Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.
• Do NOT cut, drill, grind or weld such containers.
• In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

SUITABLE CONTAINER
• Lined metal can, lined metal pail/ can.
• Plastic pail.
• Polyliner drum.
• Packing as recommended by manufacturer.

STORAGE INCOMPATIBILITY
■ Avoid contamination of water, foodstuffs, feed or seed.
• Avoid reaction with oxidising agents.

STORAGE REQUIREMENTS
• Store in original containers.
• Keep containers securely sealed.
• Store in a cool, dry, well-ventilated area.
• Store away from incompatible materials and foodstuff containers.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS
The following materials had no OELs on our records
• gum xanthan: CAS:11138- 66- 2

PERSONAL PROTECTION



RESPIRATOR
Particulate

EYE
• Safety glasses with side shields
• Chemical goggles.
• Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment

continued...

only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET

■ Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
• frequency and duration of contact,
• chemical resistance of glove material,
• glove thickness and
• dexterity.
Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.
• polychloroprene
• nitrile rubber
• butyl rubber
• fluorocaoutchouc.

OTHER

■ No special equipment needed when handling small quantities.
OTHERWISE:
• Overalls.
• Barrier cream.
• Eyewash unit.

ENGINEERING CONTROLS

• Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
• If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered.
Such protection might consist of:
(a): particle dust respirators, if necessary, combined with an absorption cartridge;
(b): filter respirators with absorption cartridge or canister of the right type;
(c): fresh-air hoods or masks.
Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

Tan granular solid; partly soluble in water.

PHYSICAL PROPERTIES

State	Divided Solid	Molecular Weight	Not Available
Melting Range (°C)	Not Available	Viscosity	Not Applicable
Boiling Range (°C)	Not Applicable	Solubility in water (g/L)	Partly Miscible
Flash Point (°C)	Not Applicable	pH (1% solution)	4.7
Decomposition Temp (°C)	Not Available	pH (as supplied)	Not Applicable
Autoignition Temp (°C)	Not Applicable	Vapour Pressure (kPa)	Not Applicable
Upper Explosive Limit (%)	Not Applicable	Specific Gravity (water=1)	~0.65
Lower Explosive Limit (%)	Not Applicable	Relative Vapour Density (air=1)	Not Applicable
Volatile Component (%vol)	Not Applicable	Evaporation Rate	Not Applicable

Section 10 - STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY

■ Product is considered stable and hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

continued...

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS
■ Not applicable.

CHRONIC HEALTH EFFECTS
■ Not applicable.

TOXICITY AND IRRITATION

AMC XAN-BORE:
■ Not available. Refer to individual constituents.

GUM XANTHAN:
■ No significant acute toxicological data identified in literature search.

Section 12 - ECOLOGICAL INFORMATION

No data
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

Section 13 - DISPOSAL CONSIDERATIONS

■ Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area.
A Hierarchy of Controls seems to be common - the user should investigate:
• Reduction.
• DO NOT allow wash water from cleaning or process equipment to enter drains.
• It may be necessary to collect all wash water for treatment before disposal.
• In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
• Where in doubt contact the responsible authority.
• Recycle wherever possible.
• Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
• Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material)
• Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:
None (ADG7)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: UN, IATA, IMDG

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE None

REGULATIONS

Regulations for ingredients

gum xanthan (CAS: 11138-66-2) is found on the following regulatory lists;
"Australia Inventory of Chemical Substances (AICS)","CODEX General Standard for Food Additives (GSFA) - Additives Permitted for Use in Food in General, Unless Otherwise Specified, in Accordance with GMP","International Fragrance Association (IFRA) Survey: Transparency List","OECD Representative List of High Production Volume (HPV) Chemicals"

continued...

No data for AMC Xan-Bore (CW: 7177-15)

Section 16 - OTHER INFORMATION

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Issue Date: 7-May-2009
Print Date: 28-Jan-2011

This is the end of the MSDS.

sodium carbonate

Hazard Alert Code: HIGH

Chemwatch Material Safety Data Sheet
Issue Date: 22-Jul-2010
XC9317TC

CHEMWATCH 10252
Version No:9
CD 2011/1 Page 1 of 8

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
sodium carbonate

SYNONYMS
Na2CO3, "soda ash light", "carbonic acid disodium salt", "soda ash dense", "crystol carbonate", "disodium carbonate", Trona, brysodash, soda(calcined), "calcined soda", DSA, "washing soda", Deltrex, Best, "Redox SOCARB50", "Merck sodium carbonate anhydrous AnalaR 10240", "sodium carbonate, anhydrous AnalaR", "Ikon Dense Soda Ash"

PRODUCT USE
Manufacture of sodium salts, glass, builder in soaps, detergents, cleaners. As a water softener; in photography; in textile bleaches; in pulp and paper manufacture; aluminium production; petroleum refining; sealing ponds from leakage; coal liquefaction catalyst; food additive.

SUPPLIER

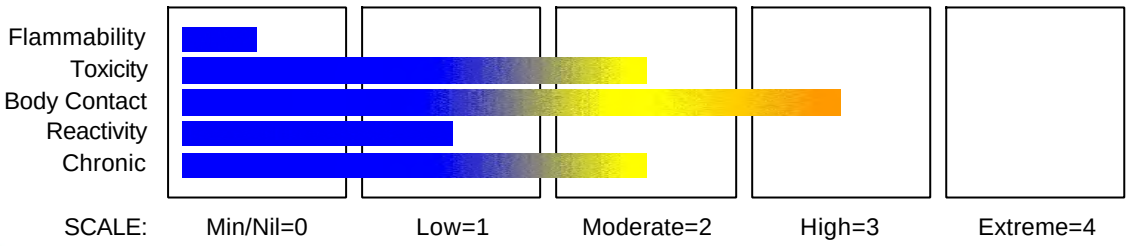
Company: AMC
Address:
5 Pitino Court
Osborne Park
WA, 6017
Australia
Telephone: 61 8 9445 4000
Emergency Tel: **61 400 966 951**
Fax: 61 8 9445 4040

Company: AMC
Address:
PO Box 1141
Osborne Park
WA, 6916
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



RISK
■ Harmful by inhalation.
■ Irritating to eyes, respiratory system and skin.

SAFETY
• Do not breathe dust.
• Avoid contact with eyes.

continued...

• Wear suitable protective clothing.
• Use only in well ventilated areas.
• Keep container in a well ventilated place.
• To clean the floor and all objects contaminated by this material, use water.
• Keep away from food, drink and animal feeding stuffs.
• In case of contact with eyes, rinse with plenty of water and contact Doctor or Poisons Information Centre.
• If swallowed, IMMEDIATELY contact Doctor or Poisons Information Centre. (show this container or label).

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
sodium carbonate	497-19-8	> 99

Section 4 - FIRST AID MEASURES

SWALLOWED
• Immediately give a glass of water.
• First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

EYE
■ If this product comes in contact with the eyes:
• Wash out immediately with fresh running water.
• Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
• Seek medical attention without delay; if pain persists or recurs seek medical attention.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin contact occurs:
• Immediately remove all contaminated clothing, including footwear.
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED
• If fumes or combustion products are inhaled remove from contaminated area.
• Lay patient down. Keep warm and rested.
• Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
• Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.

NOTES TO PHYSICIAN
■ For acute or short-term repeated exposures to highly alkaline materials:
• Respiratory stress is uncommon but present occasionally because of soft tissue edema.
• Unless endotracheal intubation can be accomplished under direct vision, cricothyroidotomy or tracheotomy may be necessary.
• Oxygen is given as indicated.
• The presence of shock suggests perforation and mandates an intravenous line and fluid administration.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• There is no restriction on the type of extinguisher which may be used.
• Use extinguishing media suitable for surrounding area.

continued...

FIRE FIGHTING
• Alert Fire Brigade and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves for fire only.
• Prevent, by any means available, spillage from entering drains or water courses.
• Use fire fighting procedures suitable for surrounding area.

FIRE/EXPLOSION HAZARD
• Non combustible.
• Not considered a significant fire risk, however containers may burn.
Decomposes on heating and produces acrid and toxic fumes of: carbon monoxide (CO), carbon dioxide (CO_2), metal oxides.
May emit poisonous fumes.
May emit corrosive fumes.

FIRE INCOMPATIBILITY
• Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.

HAZCHEM
None

Personal Protective Equipment
Gloves, boots (chemical resistant).
Breathing apparatus.

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
• Remove all ignition sources.
• Clean up all spills immediately.
• Avoid contact with skin and eyes.
• Control personal contact by using protective equipment.

MAJOR SPILLS
■ Moderate hazard.
• CAUTION: Advise personnel in area.
• Alert Emergency Services and tell them location and nature of hazard.
• Control personal contact by wearing protective clothing.
• Prevent, by any means available, spillage from entering drains or water courses.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Avoid all personal contact, including inhalation.
• Wear protective clothing when risk of exposure occurs.
• Use in a well-ventilated area.
• Prevent concentration in hollows and sumps.
Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.
• Do NOT cut, drill, grind or weld such containers.
• In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

SUITABLE CONTAINER
• DO NOT use aluminium or galvanised containers.
• Polyethylene or polypropylene container.
• Check all containers are clearly labelled and free from leaks.

continued...

STORAGE INCOMPATIBILITY
■ Sodium carbonate:
• aqueous solutions are strong bases
• reacts violently with finely divided aluminium, fluorine, lithium, phosphorus pentoxide, sulfuric acid
• reacts with fluorine gas at room temperature, generating incandescence.
• is incompatible with organic anhydrides, acrylates, alcohols, aldehydes, alkylene oxides, substituted allyls, cellulose nitrate, cresols, caprolactam solution, epichlorohydrin, ethylene dichloride, isocyanates, ketones, glycols, nitrates, phenols, phosphorus pentoxide 2,4,6-trinitrotoluene.
• Metals and their oxides or salts may react violently with chlorine trifluoride and bromine trifluoride.
• These trifluorides are hypergolic oxidisers. They ignites on contact (without external source of heat or ignition) with recognised fuels - contact with these materials, following an ambient or slightly elevated temperature, is often violent and may produce ignition.
• The state of subdivision may affect the results.
• In presence of moisture, the material is corrosive to aluminium, zinc and tin producing highly flammable hydrogen gas.
• Avoid strong acids, acid chlorides, acid anhydrides and chloroformates.
• Avoid contact with copper, aluminium and their alloys.

PACKAGING MATERIAL INCOMPATIBILITIES

Chemical Name	Container Type
Soda Ash (see Sodium Carbonate)	Aluminum

STORAGE REQUIREMENTS
• Store in original containers.
• Keep containers securely sealed.
• Store in a cool, dry area protected from environmental extremes.
• Store away from incompatible materials and foodstuff containers.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS
The following materials had no OELs on our records
• sodium carbonate: CAS:497- 19- 8

PERSONAL PROTECTION




RESPIRATOR
• particulate.

EYE
• Safety glasses with side shields.
• Chemical goggles.
• Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET
■ Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
• frequency and duration of contact,
• chemical resistance of glove material,
• glove thickness and
• dexterity.

continued...

Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.
• polychloroprene
• nitrile rubber
• butyl rubber
• fluorocaoutchouc.

OTHER
• Overalls.
• P.V.C. apron.
• Barrier cream.
• Skin cleansing cream.

ENGINEERING CONTROLS
■ Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
White hygroscopic odourless powder / granular mildly alkaline solid: mixes with water (215 g/l, 20 C; 45.5 g/100 ml, 100 C). Soluble in glycerol and slightly soluble in alcohol. Bitter alkaline taste. On exposure to air, will gradually absorb one mole of water. Typical bulk density 60-65 lbs/cft
There are two forms of sodium carbonate available, light soda and dense soda. Impurities of sodium carbonate may include water (< 1.5 %), sodium chloride (< 0.5 %), sulphate (< 0.1 %), calcium (< 0.1 %), magnesium (< 0.1 %) and iron (< 0.004 %). The purity and the impurity profile depends on the composition of the raw materials, the production process and the intended use of the product. For example the purity of the pharmaceutical grade must be higher than 99.5 % in Europe
The average particle size diameter (d50) of light sodium carbonate is in the range of 90 to 150 um and of dense sodium carbonate is in the range of 250 to 500 um.

PHYSICAL PROPERTIES
Solid.
Mixes with water.
Alkaline.

State	Divided solid	Molecular Weight	106
Melting Range (°C)	851	Viscosity	Not Applicable
Boiling Range (°C)	Not Applicable	Solubility in water (g/L)	Miscible
Flash Point (°C)	Not applicable	pH (1% solution)	11.3
Decomposition Temp (°C)	>400	pH (as supplied)	Not applicable
Autoignition Temp (°C)	Not applicable	Vapour Pressure (kPa)	Not applicable
Upper Explosive Limit (%)	Not applicable	Specific Gravity (water=1)	2.53 @ 20 C
Lower Explosive Limit (%)	Not applicable	Relative Vapour Density (air=1)	Not applicable.
Volatile Component (%vol)	Not applicable	Evaporation Rate	Not applicable

Section 10 - STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY
• Presence of incompatible materials.
• Product is considered stable.
• Hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS
ACUTE HEALTH EFFECTS

CHRONIC HEALTH EFFECTS

continued...

■ Harmful by inhalation.

■ Irritating to eyes, respiratory system and skin.

■ Cumulative effects may result following exposure*.
■ * (limited evidence).

TOXICITY AND IRRITATION
SODIUM CARBONATE:
■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY
Oral (rat) LD50: 4090 mg/kg
Inhalation (rat) LC50: 2300 mg/m³/2h
Oral (Rat) LD50: 2800 mg/kg *
Dermal (Rat) LD50: >2000 mg/kg *
Oral (Human) LD: 714 mg/kg
Oral (Mouse) LD50: 6600 mg/kg
Inhalation (Mouse) LC50: 1200 mg/m³/2h
Intraperitoneal (Mouse) LD50: 117 mg/kg
Inhalation (Guinea pig) LC50: 800 mg/m³/2h
Subcutaneous (Mouse) LD50: 2210 mg/kg

IRRITATION
Skin (rabbit): 500 mg/24h Mild
Eye (rabbit): 100 mg/24h Moderate
Eye (rabbit): 100 mg/30s Mild
Eye (rabbit): 50 mg SEVERE

■ Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound.
for sodium carbonate:
Sodium carbonate has no or a low skin irritation potential but it is considered irritating to the eyes. Due to the alkaline properties an irritation of the respiratory tract is also possible.<</>.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling epidermis.

Section 12 - ECOLOGICAL INFORMATION

No data

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
sodium carbonate	LOW	No Data Available	LOW	HIGH

GESAMP/EHS COMPOSITE LIST - GESAMP Hazard Profiles

Name / Cas No / RTECS No	EHS	TRN	A1a	A1b	A1	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3
Sodium carbonate / CAS:497-19- 8 /	1243	646	Inorg	0	0	Inorg	1	NI	0	0	3	1	2			SD	2

Legend:
EHS=EHS Number (EHS=GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships) NRT=Net Register Tonnage, A1a=Bioaccumulation log Pow, A1b=Bioaccumulation BCF, A1=Bioaccumulation, A2=Biodegradation, B1=Acuteaquatic toxicity LC/ECIC50 (mg/l), B2=Chronic aquatic toxicity NOEC (mg/l), C1=Acute mammalian oral toxicity LD50 (mg/kg), C2=Acutemammalian dermal toxicity LD50 (mg/kg), C3=Acute mammalian inhalation toxicity LC50 (mg/kg), D1=Skin irritation & corrosion, D2=Eye irritation& corrosion, D3=Long-term health effects, E1=Tainting, E2=Physical effects on wildlife & benthic habitats, E3=Interference with coastal amenities,
For column A2: R=Readily biodegradable, NR=Not readily biodegradable.
For column D3: C=Carcinogen, M=Mutagenic, R=Reprotoxic, S=Sensitising, A=Aspiration hazard, T=Target organ systemic toxicity, L=Lunginjury, N=Neurotoxic, I=Immunotoxic.
For column E1: NT=Not tainting (tested), T=Tainting test positive.

continued...

For column E2: Fp=Persistent floater, F=Floater, S=Sinking substances.
The numerical scales start from 0 (no hazard), while higher numbers reflect increasing hazard.
(GESAMP/EHS Composite List of Hazard Profiles - Hazard evaluation of substances transported by ships)

Section 13 - DISPOSAL CONSIDERATIONS

■ Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area.
A Hierarchy of Controls seems to be common - the user should investigate:
• Reduction.
• DO NOT allow wash water from cleaning or process equipment to enter drains.
• It may be necessary to collect all wash water for treatment before disposal.
• In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
• Where in doubt contact the responsible authority.
• Recycle wherever possible.
• Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
• Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material)
• Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:
None (ADG7)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: UN, IATA, IMDG

GESAMP hazard profiles for this material can be found in section 12 of the MSDS.

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE None

REGULATIONS

sodium carbonate (CAS: 497-19-8) is found on the following regulatory lists;
"Australia Hazardous Substances","Australia High Volume Industrial Chemical List (HVICL)","Australia Inventory of Chemical Substances (AICS)","CODEX General Standard for Food Additives (GSFA) - Additives Permitted for Use in Food in General, Unless Otherwise Specified, in Accordance with GMP","GESAMP/EHS Composite List - GESAMP Hazard Profiles","IMO IBC Code Chapter 17: Summary of minimum requirements","International Council of Chemical Associations (ICCA) - High Production Volume List","OECD Representative List of High Production Volume (HPV) Chemicals"

Section 16 - OTHER INFORMATION

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

continued...

Issue Date: 22-Jul-2010
Print Date: 24-May-2011

This is the end of the MSDS.

MATERIAL SAFETY DATA SHEET

RESIDRILL

NOT HAZARDOUS*

Substance:	Residrill	Approved Criteria Classification:	Not allocated
Trade Names:		SUSDP Classification:	Not allocated
Product Use:	Filtrate Loss Control Drilling Mud Additive	ADG:	Not allocated
Creation Date:	23−May−2006	UN Number:	0
Revision Date:	23−May−2006		

* According to the criteria of NOHSC

Quick Summary*

General Properties:	Powder to flake, 50 to 500 mesh,, , No odour
Major Health Hazards:	
PPE:	
Extinguishing Media:	Water
Environment:	Sweep up but avoid stirring up dust. Dispose of in accordance with relevant local legislation. Avoid wetting product as it impedes flow, wear dust masks to avoid breathing dust, wear goggles and gloves to avoid drying skin and eyes.
Disposal:	

Handling and Storage

Storage:	Store in a dry area. Keep containers closed at all times.
Exposure Limits:	Not available
Ventilation:	Use in a well ventilated area. Local exhaust ventilation.
Eye Protection:	 Recommended
Skin Protection:	 Suggested
Repiratory Protection:	

Protective Material Types:	

First Aid Measures

Scheduled Poisons:	
Inhalation:	Remove to fresh air. Seek medical attention if symptoms persist.
Skin Contact:	Wash with soap and water. Maintain good personal hygiene practises.
Eye Contact:	Irrigate the eye(s) with water for at least 15 minutes. Seek medical attention if symptoms persist.
Ingestion:	Dilute with plenty of water.

Potential Health Effects

Inhalation:	Nuisance dust, Signs of Exposure − Coughing & sneezing.
Skin Contact:	Wash with soap and water. Maintain good personal hygiene practises.
Eye Contact:	My cause irritation.
Ingestion:	Dilute with plenty of water.
Carcionogen (NOHSC, NTP, IARC):	Nil, NTP− IARC Monographs, OSHA Regulated No.
Major Health Hazards Summary:	

Fire Fighting Measures

Fire and Explosion Hazards:	Finely concentrated dust ma become explosive. Spray with water.
Extinguishing Media:	Water
Fire Fighting Instructions:	None
Flash Point:	Not available

Accidental Release Measures

Occupational Release:	Sweep up but avoid stirring up dust. Dispose of in accordance with relevant local legislation. Avoid wetting product as it impedes flow, wear dust masks to avoid breathing dust, wear goggles and gloves to avoid drying skin and eyes.

Environmental Information

Accidental Release:	Clean up spills to avoid dust, beware wet surfaces as they may be slick.
Environmental Risk Rating (EU Rating):	Not available
Environmental Toxicity:	Not available
Disposal Considerations:	

Toxicological Information

Ingredients	***CAS Number***	***Proportion***
A of mixture of vegetable derive materials, stabilized with water soluble synthetic and partially soluble organic polymers and insoluble oxides.		100%

Individual Ingredient Information

A of mixture of vegetable derive materials, stabilized with water soluble synthetic and partially soluble organic polymers and insoluble oxides.

Irritation Data:	

Toxicity Data:	
Local Effects:	
Acute Toxicity Level:	
Target Organs:	
Mutagenic Data:	
Reproductive Effects Data:	
Other:	

Physical and Chemical Properties

Physical State:	Powder to flake, 50 to 500 mesh,	Specific Gravity:	< 1
Colour:		Water Solubility:	Partially soluble
Odour:	No odour	pH:	Not available
Boiling Point:	Not available	Volatility:	Not available
Freezing Point:	Not available	Odour Threshold:	Not available
Vapour Pressure:	Not available	Evaporation Rate:	Not available
Vapour Density:	Not available	Coefficient of Water/Oil Distrib:	Not available

Stability and Reactivity

Reactivity:	Stable
Conditions to Avoid:	Not known
Incompatibilities:	Not known
Hazardous Decomposition:	Not known
Polymerization:	Will not occur

Transport Information

ADG Code:	Not allocated
Hazchem Code:	Not allocated
Special Provision:	Not allocated
Packaging Group:	0
Packaging Method:	Not allocated

Regulatory Information

Significant Legislation:	

Other Information

Contact Point:	Australian Mud Company Phone +61 8 9445 4000 mobile 0409 114 627
Other Information:	The information presented in this MSDS was obtained from recognised published data and is as accurate as possible. Since Australian Mud Company Pty Ltd cannot anticipate the conditions under which this information may be used, it is the user's responsibility to review the information in the context of the specific intended application an to comply with the federal, state and local government regulations controlling the disposal of the product.

AMC P.H.P.A.

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AMC P.H.P.A.

SYNONYMS
"CR 650"

PRODUCT USE
Drilling fluid additive.

SUPPLIER

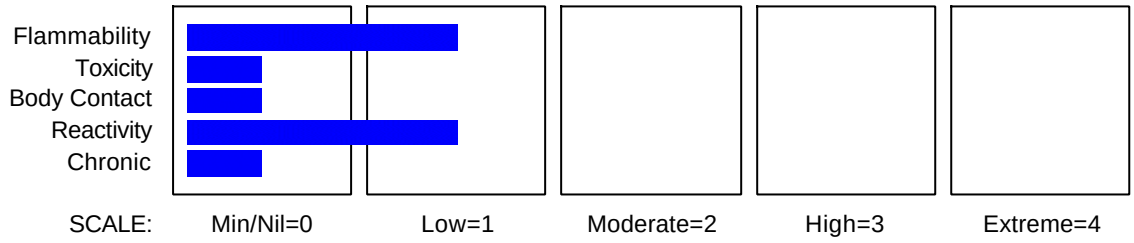
Company: AMC
Address:
5 Pitino Court
Osborne Park
WA, 6017
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Company: AMC
Address:
PO Box 1141
Osborne Park
WA, 6916
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



RISK
•None under normal operating conditions.

SAFETY
•None under normal operating conditions.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
acrylic acid/ acrylamide copolymer, sodium salt	25987-30-8	>90
diluter		0-10

continued...

Section 4 - FIRST AID MEASURES

SWALLOWED
• If swallowed do NOT induce vomiting.
• If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
• Observe the patient carefully.
• Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

EYE
■ If this product comes in contact with the eyes:
• Wash out immediately with fresh running water.
• Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
• Seek medical attention without delay; if pain persists or recurs seek medical attention.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin contact occurs:
• Immediately remove all contaminated clothing, including footwear.
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED
• If dust is inhaled, remove from contaminated area.
• Encourage patient to blow nose to ensure clear passage of breathing.
• If irritation or discomfort persists seek medical attention.

NOTES TO PHYSICIAN
■ Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• There is no restriction on the type of extinguisher which may be used.
• Use extinguishing media suitable for surrounding area.

FIRE FIGHTING
• Alert Fire Brigade and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves for fire only.
• Prevent, by any means available, spillage from entering drains or water courses.
• Use fire fighting procedures suitable for surrounding area.

FIRE/EXPLOSION HAZARD
• Solid which exhibits difficult combustion or is difficult to ignite.
• Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion.
• Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust (420 micron or less) may burn rapidly and fiercely if ignited; once initiated larger particles up to 1400 microns diameter will contribute to the propagation of an explosion.
• A dust explosion may release of large quantities of gaseous products; this in turn creates a subsequent pressure rise of explosive force capable of damaging plant and buildings and injuring people.
Combustion products include: carbon monoxide (CO), carbon dioxide (CO_2), other pyrolysis products typical of burning organic material.

FIRE INCOMPATIBILITY
• Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.

HAZCHEM
None

PERSONAL PROTECTION

Glasses:	Gloves:	Respirator:
Chemical goggles.	When handling larger quantities:	Particulate

continued...

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
• Clean up all spills immediately.
• Avoid contact with skin and eyes.
• Wear impervious gloves and safety glasses.
• Use dry clean up procedures and avoid generating dust.

MAJOR SPILLS
• Clear area of personnel and move upwind.
• Alert Fire Brigade and tell them location and nature of hazard.
• Control personal contact by using protective equipment and dust respirator.
• Prevent spillage from entering drains, sewers or water courses.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Limit all unnecessary personal contact.
• Wear protective clothing when risk of exposure occurs.
• Use in a well-ventilated area.
• Avoid contact with incompatible materials.
Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.
• Do NOT cut, drill, grind or weld such containers.
• In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

SUITABLE CONTAINER
• Lined metal can, lined metal pail/ can.
• Plastic pail.
• Polyliner drum.
• Packing as recommended by manufacturer.

STORAGE INCOMPATIBILITY
■ Avoid contamination of water, foodstuffs, feed or seed.
• Avoid reaction with oxidising agents.

STORAGE REQUIREMENTS
• Store in original containers.
• Keep containers securely sealed.
• Store in a cool, dry, well-ventilated area.
• Store away from incompatible materials and foodstuff containers.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS
The following materials had no OELs on our records
• acrylic acid/ acrylamide copolymer, sodium salt: CAS:25987- 30- 8 CAS:25085- 02- 3

PERSONAL PROTECTION



continued...

RESPIRATOR
Particulate

EYE
- Safety glasses with side shields
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET
■ Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity.

Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.
- polychloroprene
- nitrile rubber
- butyl rubber
- fluorocaoutchouc.

OTHER
■ No special equipment needed when handling small quantities.
OTHERWISE:
- Overalls.
- Barrier cream.
- Eyewash unit.

ENGINEERING CONTROLS
- Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
- If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered.

Such protection might consist of:
(a): particle dust respirators, if necessary, combined with an absorption cartridge;
(b): filter respirators with absorption cartridge or canister of the right type;
(c): fresh-air hoods or masks.
Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Fine granular free-flowing solid; soluble in water.

PHYSICAL PROPERTIES
Mixes with water.

State	Divided Solid	Molecular Weight	Not Applicable
Melting Range (°C)	Not Available	Viscosity	Not Applicable
Boiling Range (°C)	Not Applicable	Solubility in water (g/L)	Miscible
Flash Point (°C)	Not Applicable	pH (1% solution)	Not Applicable
Decomposition Temp (°C)	Not Available	pH (as supplied)	~7.5
Autoignition Temp (°C)	Not Available	Vapour Pressure (kPa)	Not Applicable
Upper Explosive Limit (%)	Not Available	Specific Gravity (water=1)	Not Available
Lower Explosive Limit (%)	Not Available	Relative Vapour Density (air=1)	Not Applicable
Volatile Component (%vol)	Not Applicable	Evaporation Rate	Not Applicable

continued...

Section 10 - STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY
■ Product is considered stable and hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS
ACUTE HEALTH EFFECTS
■ Not applicable.

CHRONIC HEALTH EFFECTS
■ Not applicable.

TOXICITY AND IRRITATION
AMC P.H.P.A.:
■ Not available. Refer to individual constituents.

ACRYLIC ACID/ ACRYLAMIDE COPOLYMER, SODIUM SALT:
■ No significant acute toxicological data identified in literature search.

Section 12 - ECOLOGICAL INFORMATION

No data
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

Section 13 - DISPOSAL CONSIDERATIONS

■ Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area.
A Hierarchy of Controls seems to be common - the user should investigate:
• Reduction.
• DO NOT allow wash water from cleaning or process equipment to enter drains.
• It may be necessary to collect all wash water for treatment before disposal.
• In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
• Where in doubt contact the responsible authority.
• Recycle wherever possible.
• Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
• Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material)
• Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:
None (ADG7)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: UN, IATA, IMDG

continued...

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE None

REGULATIONS

Regulations for ingredients

acrylic acid/ acrylamide copolymer, sodium salt (CAS: 25987-30-8,25085-02-3) is found on the following regulatory lists;
"Australia Inventory of Chemical Substances (AICS)"

No data for AMC P.H.P.A. (CW: 7176-55)

Section 16 - OTHER INFORMATION

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
acrylic acid/ acrylamide copolymer, sodium salt	25987-30-8, 25085-02-3

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Issue Date: 5-May-2009
Print Date: 28-Jan-2011

This is the end of the MSDS.

AMC PAC L

Hazard Alert Code: LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AMC PAC L

SYNONYMS
AMC-PAC, "AMC-PAC R"

PRODUCT USE
Drilling fluids compound.
Viscosifier/fluid loss reducer.

SUPPLIER

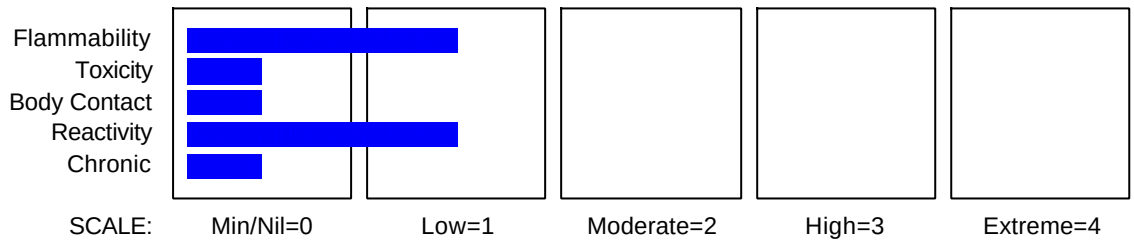
Company: AMC
Address:
5 Pitino Court
Osborne Park
WA, 6017
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Company: AMC
Address:
PO Box 1141
Osborne Park
WA, 6916
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



RISK
•None under normal operating conditions.

SAFETY
•None under normal operating conditions.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
sodium carboxymethylcellulose (polyanionic cellulose)	9004-32-4	100

continued...

Section 4 - FIRST AID MEASURES

SWALLOWED
• If swallowed do NOT induce vomiting.
• If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
• Observe the patient carefully.
• Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

EYE
■ If this product comes in contact with the eyes:
• Wash out immediately with fresh running water.
• Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
• Seek medical attention without delay; if pain persists or recurs seek medical attention.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin or hair contact occurs:
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED
• If dust is inhaled, remove from contaminated area.
• Encourage patient to blow nose to ensure clear passage of breathing.
• If irritation or discomfort persists seek medical attention.

NOTES TO PHYSICIAN
■ Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• There is no restriction on the type of extinguisher which may be used.
• Use extinguishing media suitable for surrounding area.

FIRE FIGHTING
• Alert Fire Brigade and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves for fire only.
• Prevent, by any means available, spillage from entering drains or water courses.
• Use fire fighting procedures suitable for surrounding area.

FIRE/EXPLOSION HAZARD
• Solid which exhibits difficult combustion or is difficult to ignite.
• Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion.
• Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust (420 micron or less) may burn rapidly and fiercely if ignited; once initiated larger particles up to 1400 microns diameter will contribute to the propagation of an explosion.
• A dust explosion may release of large quantities of gaseous products; this in turn creates a subsequent pressure rise of explosive force capable of damaging plant and buildings and injuring people.
Combustion products include: carbon monoxide (CO), carbon dioxide (CO_2), other pyrolysis products typical of burning organic material.

FIRE INCOMPATIBILITY
• Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.

HAZCHEM
None

PERSONAL PROTECTION

Glasses:	Gloves:	Respirator:
Chemical goggles.	When handling larger quantities:	Particulate

continued...

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
• Clean up all spills immediately.
• Avoid contact with skin and eyes.
• Wear impervious gloves and safety glasses.
• Use dry clean up procedures and avoid generating dust.

MAJOR SPILLS
• Clear area of personnel and move upwind.
• Alert Fire Brigade and tell them location and nature of hazard.
• Control personal contact by using protective equipment and dust respirator.
• Prevent spillage from entering drains, sewers or water courses.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Limit all unnecessary personal contact.
• Wear protective clothing when risk of exposure occurs.
• Use in a well-ventilated area.
• Avoid contact with incompatible materials.

SUITABLE CONTAINER
■ Multi-ply paper bag with sealed plastic liner or heavy gauge plastic bag.

NOTE: Bags should be stacked, blocked, interlocked, and limited in height so that they are stable and secure against sliding or collapse.
• Lined metal can, lined metal pail/ can.
• Plastic pail.
• Polyliner drum.
• Packing as recommended by manufacturer.

STORAGE INCOMPATIBILITY
■ Avoid contamination of water, foodstuffs, feed or seed.
Cellulose and its derivatives may react vigorously with calcium oxide, bleaching powder, perchlorates, perchloric acid, sodium chlorate, fluorine, nitric acid, sodium nitrate and sodium nitrite.
May be incompatible with aminacrine hydrochloride, chlorocresol, mercuric chloride, phenol, resorcinol, tannic acid and silver nitrate.
• Avoid reaction with oxidising agents.

STORAGE REQUIREMENTS
• Store in original containers.
• Keep containers securely sealed.
• Store in a cool, dry, well-ventilated area.
• Store away from incompatible materials and foodstuff containers.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS
The following materials had no OELs on our records
• sodium carboxymethylcellulose: CAS:9004- 32- 4

PERSONAL PROTECTION



continued...

RESPIRATOR
Particulate

EYE
- Safety glasses with side shields
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET
■ Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity.

Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.
- polychloroprene
- nitrile rubber
- butyl rubber
- fluorocaoutchouc.

OTHER
■ No special equipment needed when handling small quantities.
OTHERWISE:
- Overalls.
- Barrier cream.
- Eyewash unit.

ENGINEERING CONTROLS
- Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
- If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered.

Such protection might consist of:
(a): particle dust respirators, if necessary, combined with an absorption cartridge;
(b): filter respirators with absorption cartridge or canister of the right type;
(c): fresh-air hoods or masks.
Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Lightly coloured odourless powder; soluble in water.

PHYSICAL PROPERTIES
Mixes with water.

State	Divided Solid	Molecular Weight	Not Applicable
Melting Range (°C)	Not Available	Viscosity	Not Applicable
Boiling Range (°C)	Not Applicable	Solubility in water (g/L)	Miscible
Flash Point (°C)	Not Applicable	pH (1% solution)	5- 8
Decomposition Temp (°C)	Not Available	pH (as supplied)	Not Applicable
Autoignition Temp (°C)	Not Available	Vapour Pressure (kPa)	Not Applicable
Upper Explosive Limit (%)	Not Available	Specific Gravity (water=1)	1.5- 1.6
Lower Explosive Limit (%)	Not Available	Relative Vapour Density (air=1)	Not Applicable
Volatile Component (%vol)	Not Applicable	Evaporation Rate	Not Applicable

continued...

Section 10 - STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY
■ Product is considered stable and hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS
ACUTE HEALTH EFFECTS
■ Not applicable.

CHRONIC HEALTH EFFECTS
■ Not applicable.

TOXICITY AND IRRITATION
AMC PAC L:
■ Not available. Refer to individual constituents.

SODIUM CARBOXYMETHYLCELLULOSE:
■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY
Oral (rat) LD50: 27000 mg/kg
Oral (rat) TDLo: 140 mg/kg
Neoplastic by RTECS criteria

IRRITATION
Nil Reported

Section 12 - ECOLOGICAL INFORMATION

No data
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

Section 13 - DISPOSAL CONSIDERATIONS

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:
None (ADG7)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: UN, IATA, IMDG

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE None

REGULATIONS

continued...

Regulations for ingredients

sodium carboxymethylcellulose (CAS: 9004-32-4) is found on the following regulatory lists;
"Australia Inventory of Chemical Substances (AICS)","CODEX General Standard for Food Additives (GSFA) - Additives Permitted for Use in Food in General, Unless Otherwise Specified, in Accordance with GMP","OECD Representative List of High Production Volume (HPV) Chemicals"

No data for AMC PAC L (CW: 7641-75)

Section 16 - OTHER INFORMATION

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Issue Date: 5-Feb-2010
Print Date: 28-Jan-2011

This is the end of the MSDS.

AMC PAC R

Hazard Alert Code: LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AMC PAC R

PRODUCT USE
Drilling fluids compound.
Viscosifier/fluid loss reducer.

SUPPLIER

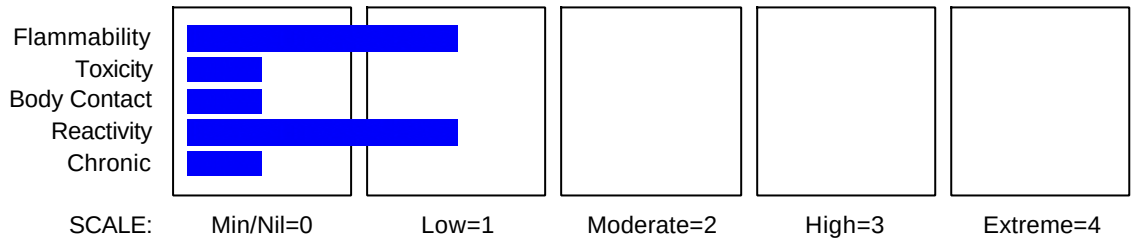
Company: AMC
Address:
5 Pitino Court
Osborne Park
WA, 6017
Australia
Telephone: 61 8 9445 4000
Emergency Tel: **61 400 966 951**
Fax: 61 8 9445 4040

Company: AMC
Address:
PO Box 1141
Osborne Park
WA, 6916
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



RISK
•None under normal operating conditions.

SAFETY
•None under normal operating conditions.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
sodium carboxymethylcellulose (polyanionic cellulose)	9004-32-4	>99

continued...

Section 4 - FIRST AID MEASURES

SWALLOWED
• If swallowed do NOT induce vomiting.
• If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
• Observe the patient carefully.
• Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

EYE
■ If this product comes in contact with the eyes:
• Wash out immediately with fresh running water.
• Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
• Seek medical attention without delay; if pain persists or recurs seek medical attention.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin or hair contact occurs:
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED
• If dust is inhaled, remove from contaminated area.
• Encourage patient to blow nose to ensure clear passage of breathing.
• If irritation or discomfort persists seek medical attention.

NOTES TO PHYSICIAN
■ Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• Water spray or fog.
• Foam.
• Dry chemical powder.
• BCF (where regulations permit).

FIRE FIGHTING
• Alert Fire Brigade and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves.
• Prevent, by any means available, spillage from entering drains or water courses.
• Use water delivered as a fine spray to control fire and cool adjacent area.

FIRE/EXPLOSION HAZARD
• Combustible solid which burns but propagates flame with difficulty; it is estimated that most organic dusts are combustible (circa 70%) - according to the circumstances under which the combustion process occurs, such materials may cause fires and / or dust explosions.
• Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion. Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust (420 micron or less) may burn rapidly and fiercely if ignited - particles exceeding this limit will generally not form flammable dust clouds.; once initiated, however, larger particles up to 1400 microns diameter will contribute to the propagation of an explosion.
• In the same way as gases and vapours, dusts in the form of a cloud are only ignitable over a range of concentrations; in principle, the concepts of lower explosive limit (LEL) and upper explosive limit (UEL).are applicable to dust clouds but only the LEL is of practical use; - this is because of the inherent difficulty of achieving homogeneous dust clouds at high temperatures (for dusts the LEL is often called the "Minimum Explosible Concentration", MEC)
• A dust explosion may release of large quantities of gaseous products; this in turn creates a subsequent pressure rise of explosive force capable of damaging plant and buildings and injuring people.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO_2), other pyrolysis products typical of burning organic material.

continued...

FIRE INCOMPATIBILITY
• Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.

HAZCHEM
None

PERSONAL PROTECTION

Glasses:	Gloves:	Respirator:
Chemical goggles.	When handling larger quantities:	Particulate

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
• Clean up all spills immediately.
• Avoid contact with skin and eyes.
• Wear impervious gloves and safety glasses.
• Use dry clean up procedures and avoid generating dust.
Slippery when wet.

MAJOR SPILLS
• Clear area of personnel and move upwind.
• Alert Fire Brigade and tell them location and nature of hazard.
• Control personal contact by using protective equipment and dust respirator.
• Prevent spillage from entering drains, sewers or water courses.
Slippery when wet.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Limit all unnecessary personal contact.
• Wear protective clothing when risk of exposure occurs.
• Use in a well-ventilated area.
• Avoid contact with incompatible materials.
Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.
• Do NOT cut, drill, grind or weld such containers.
• In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

SUITABLE CONTAINER
• Lined metal can, lined metal pail/ can.
• Plastic pail.
• Polyliner drum.
• Packing as recommended by manufacturer.
• Glass container is suitable for laboratory quantities.

STORAGE INCOMPATIBILITY
■ Avoid contamination of water, foodstuffs, feed or seed.
Cellulose and its derivatives may react vigorously with calcium oxide, bleaching powder, perchlorates, perchloric acid, sodium chlorate, fluorine, nitric acid, sodium nitrate and sodium nitrite.
May be incompatible with aminacrine hydrochloride, chlorocresol, mercuric chloride, phenol, resorcinol, tannic acid and silver nitrate.
• Avoid reaction with oxidising agents.

STORAGE REQUIREMENTS
• Store in original containers.
• Keep containers securely sealed.

continued...

• Store in a cool, dry, well-ventilated area.
• Store away from incompatible materials and foodstuff containers.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS
The following materials had no OELs on our records
• sodium carboxymethylcellulose: CAS:9004- 32- 4

PERSONAL PROTECTION



RESPIRATOR
• particulate.

EYE
• Safety glasses with side shields
• Chemical goggles.
• Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET
■ Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
• frequency and duration of contact,
• chemical resistance of glove material,
• glove thickness and
• dexterity.
Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.
• polychloroprene
• nitrile rubber
• butyl rubber
• fluorocaoutchouc.

OTHER
■ No special equipment needed when handling small quantities.
OTHERWISE:
• Overalls.
• Barrier cream.
• Eyewash unit.

ENGINEERING CONTROLS
• Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
• Exhaust ventilation should be designed to prevent accumulation and recirculation of particulates in the workplace.
• If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered. Such protection might consist of:
(a): particle dust respirators, if necessary, combined with an absorption cartridge;
(b): filter respirators with absorption cartridge or canister of the right type;
(c): fresh-air hoods or masks
• Build-up of electrostatic charge on the dust particle, may be prevented by bonding and grounding.

continued...

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Lightly coloured odourless powder; soluble in water.

PHYSICAL PROPERTIES
Mixes with water.

State	Divided Solid	Molecular Weight	Not Applicable
Melting Range (°C)	Not Available	Viscosity	Not Applicable
Boiling Range (°C)	Not Applicable	Solubility in water (g/L)	Miscible
Flash Point (°C)	Not Available	pH (1% solution)	Not Available
Decomposition Temp (°C)	Not Available	pH (as supplied)	Not Applicable
Autoignition Temp (°C)	Not Available	Vapour Pressure (kPa)	Not Applicable
Upper Explosive Limit (%)	Not Available	Specific Gravity (water=1)	1.5- 1.6
Lower Explosive Limit (%)	Not Available	Relative Vapour Density (air=1)	Not Applicable
Volatile Component (%vol)	Not Available	Evaporation Rate	Not Applicable

Section 10 - STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY
■ Product is considered stable and hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS
ACUTE HEALTH EFFECTS
• Generally not applicable.

CHRONIC HEALTH EFFECTS
• Generally not applicable.

TOXICITY AND IRRITATION
AMC PAC R:
■ Not available. Refer to individual constituents.

SODIUM CARBOXYMETHYLCELLULOSE:
■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY
Oral (rat) LD50: 27000 mg/kg
Oral (rat) TDLo: 140 mg/kg
Neoplastic by RTECS criteria

IRRITATION
Nil Reported

Section 12 - ECOLOGICAL INFORMATION

No data
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
AMC PAC R	No Data Available	No Data Available		

continued...

sodium carboxymethylcellulose	No Data Available	No Data Available

Section 13 - DISPOSAL CONSIDERATIONS

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:
None (ADG7)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: UN, IATA, IMDG

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE None

REGULATIONS

Regulations for ingredients

sodium carboxymethylcellulose (CAS: 9004-32-4) is found on the following regulatory lists;
"Australia Inventory of Chemical Substances (AICS)","CODEX General Standard for Food Additives (GSFA) - Additives Permitted for Use in Food in General, Unless Otherwise Specified, in Accordance with GMP","OECD Representative List of High Production Volume (HPV) Chemicals"

No data for AMC PAC R (CW: 4730-46)

Section 16 - OTHER INFORMATION

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Issue Date: 5-Feb-2010
Print Date: 24-May-2011

This is the end of the MSDS.

AMC Kwik Seal

Hazard Alert Code: LOW

Chemwatch Material Safety Data Sheet
Issue Date: 18-Jan-2011
XC9317TC

CHEMWATCH 4734-73
Version No:2.0

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AMC Kwik Seal

PRODUCT USE
Drilling fluid lost. Circulation material.
In coarse, medium and fine grades.

SUPPLIER

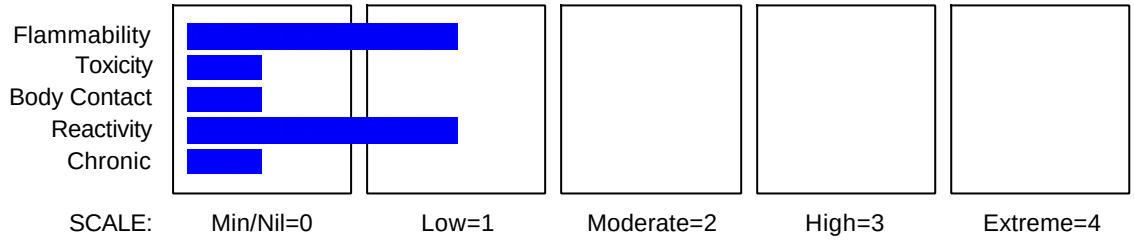
Company: AMC
Address:
5 Pitino Court
Osborne Park
WA, 6017
Australia
Telephone: 61 8 9445 4000
Emergency Tel: **61 400 966 951**
Fax: 61 8 9445 4040

Company: AMC
Address:
PO Box 1141
Osborne Park
WA, 6916
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



RISK
•None under normal operating conditions.

SAFETY
•None under normal operating conditions.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
blend of nut hulls, wood fibre and cellophane		100

continued...

Section 4 - FIRST AID MEASURES

SWALLOWED
• Immediately give a glass of water.
• First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

EYE
■ If this product comes in contact with eyes:
• Wash out immediately with water.
• If irritation continues, seek medical attention.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin or hair contact occurs:
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED
• If dust is inhaled, remove from contaminated area.
• Encourage patient to blow nose to ensure clear passage of breathing.
• If irritation or discomfort persists seek medical attention.

NOTES TO PHYSICIAN
■ Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• Foam.
• Dry chemical powder.
• BCF (where regulations permit).
• Carbon dioxide.

FIRE FIGHTING
• Alert Fire Brigade and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves.
• Prevent, by any means available, spillage from entering drains or water courses.
• Use water delivered as a fine spray to control fire and cool adjacent area.

FIRE/EXPLOSION HAZARD
• Solid which exhibits difficult combustion or is difficult to ignite.
• Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion.
• Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust (420 micron or less) may burn rapidly and fiercely if ignited; once initiated larger particles up to 1400 microns diameter will contribute to the propagation of an explosion.
• A dust explosion may release of large quantities of gaseous products; this in turn creates a subsequent pressure rise of explosive force capable of damaging plant and buildings and injuring people.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO_2), nitrogen oxides (NOx), other pyrolysis products typical of burning organic material.

FIRE INCOMPATIBILITY
• Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.

HAZCHEM
None

PERSONAL PROTECTION

Glasses:	Gloves:	Respirator:
Chemical goggles.	When handling larger quantities:	Particulate

continued...

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
• Clean up all spills immediately.
• Avoid contact with skin and eyes.
• Wear impervious gloves and safety glasses.
• Use dry clean up procedures and avoid generating dust.

MAJOR SPILLS
• Clear area of personnel and move upwind.
• Alert Fire Brigade and tell them location and nature of hazard.
• Control personal contact by using protective equipment and dust respirator.
• Prevent spillage from entering drains, sewers or water courses.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Limit all unnecessary personal contact.
• Wear protective clothing when risk of exposure occurs.
• Use in a well-ventilated area.
• Avoid contact with incompatible materials.
Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.
• Do NOT cut, drill, grind or weld such containers.
• In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

SUITABLE CONTAINER
• Lined metal can, lined metal pail/ can.
• Plastic pail.
• Polyliner drum.
• Packing as recommended by manufacturer.

STORAGE INCOMPATIBILITY
■ Avoid contamination of water, foodstuffs, feed or seed.
• Avoid reaction with oxidising agents.

STORAGE REQUIREMENTS
• Store in original containers.
• Keep containers securely sealed.
• Store in a cool, dry, well-ventilated area.
• Store away from incompatible materials and foodstuff containers.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

PERSONAL PROTECTION



continued...

RESPIRATOR
• particulate.

EYE
• Safety glasses with side shields
• Chemical goggles.
• Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET
■ Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
• frequency and duration of contact,
• chemical resistance of glove material,
• glove thickness and
• dexterity.
Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.
• polychloroprene
• nitrile rubber
• butyl rubber
• fluorocaoutchouc.

OTHER
■ No special equipment needed when handling small quantities.
OTHERWISE:
• Overalls.
• Barrier cream.
• Eyewash unit.

ENGINEERING CONTROLS
• Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
• Exhaust ventilation should be designed to prevent accumulation and recirculation of particulates in the workplace.
• If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered. Such protection might consist of:
(a): particle dust respirators, if necessary, combined with an absorption cartridge;
(b): filter respirators with absorption cartridge or canister of the right type;
(c): fresh-air hoods or masks
• Build-up of electrostatic charge on the dust particle, may be prevented by bonding and grounding.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Fibrous, flake and granular solids with a slight odour; insoluble in water.

PHYSICAL PROPERTIES
Does not mix with water.

State	Divided Solid	Molecular Weight	Not Applicable
Melting Range (°C)	Not Available	Viscosity	Not Applicable
Boiling Range (°C)	~100	Solubility in water (g/L)	Immiscible
Flash Point (°C)	Not Available	pH (1% solution)	Not Applicable
Decomposition Temp (°C)	Not Available	pH (as supplied)	Not Applicable
Autoignition Temp (°C)	Not Available	Vapour Pressure (kPa)	Not Applicable
Upper Explosive Limit (%)	Not Available	Specific Gravity (water=1)	0.9- 1.2
Lower Explosive Limit (%)	Not Available	Relative Vapour Density (air=1)	Not Applicable
Volatile Component (%vol)	Not Applicable	Evaporation Rate	Not Applicable

continued...

Section 10 - STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY
■ Product is considered stable and hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS
ACUTE HEALTH EFFECTS
• Generally not applicable.

CHRONIC HEALTH EFFECTS
• Generally not applicable.

TOXICITY AND IRRITATION
AMC KWIK SEAL:
■ Not available. Refer to individual constituents.

Section 12 - ECOLOGICAL INFORMATION

No data
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
AMC Kwik Seal	No Data Available	No Data Available		

Section 13 - DISPOSAL CONSIDERATIONS

■ Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area.
A Hierarchy of Controls seems to be common - the user should investigate:
• Reduction.
• DO NOT allow wash water from cleaning or process equipment to enter drains.
• It may be necessary to collect all wash water for treatment before disposal.
• In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
• Where in doubt contact the responsible authority.
• Recycle wherever possible.
• Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
• Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material)
• Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:
None (ADG7)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: UN, IATA, IMDG

continued...

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE None

REGULATIONS

No data for AMC Kwik Seal (CW: 4734-73)

Section 16 - OTHER INFORMATION

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Issue Date: 18-Jan-2011
Print Date: 24-May-2011

This is the end of the MSDS.

MATERIAL SAFETY DATA SHEET

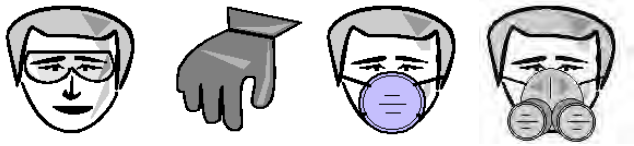
POTASSIUM CHLORIDE

NOT HAZARDOUS*

Substance:	Potassium Chloride	Approved Criteria Classification:	Not allocated
Trade Names:	Muriate of potash chloride, KCL	SUSDP Classification:	Not allocated
Product Use:	Shale inhibitor. Change of Revision due to document review only.	ADG:	Not allocated
Creation Date:	7−Sep−1999	UN Number:	0
Revision Date:	21−Mar−2006		

* According to the criteria of NOHSC

Quick Summary*

General Properties:	Solid (powder), White, Not available
Major Health Hazards:	Irritant to eye if exposed. Gastro intestinal irritation occurs if swallowed in large doses.
PPE:	
Extinguishing Media:	Not available
Environment:	Avoid slips and falls. Wear protective equipment to prevent skin, eye and respiratory system contamination. Contain the spill. Prevent any accidental release from entering stormwater drains and reaching exposed surface areas. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent . Shovel/scrape into containers for disposal. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation.
Disposal:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent. Shovel absorbent into suitable, sealable, labelled drum for disposal.

Handling and Storage

Storage:	Store in a dry area. Keep dust to a minimum.
Exposure Limits:	No exposure limit has been established but the following should be considered: ACGIH TLV−TWA for nuisance dust: = 10 mg/m³ total dust, or 5mg/m3 for respirable dust.
Ventilation:	Use in well ventilated area.

Eye Protection:	
Skin Protection:	 Rubber or cotton.
Repiratory Protection:	 Or respirator  RECOMMENDED (AS1715, AS1716)
Protective Material Types:	

First Aid Measures	
Scheduled Poisons:	Not allocated
Inhalation:	Remove to fresh air. Seek medical attention.
Skin Contact:	Wash with mild soap and water.
Eye Contact:	Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Seek immediate medical assistance.
Ingestion:	INDUCE VOMITING. Rinse mouth with water. Give water to dilute. Seek medical attention and contact nearest Poisons Information Center.

Potential Health Effects	
Inhalation:	Not irritating if inhaled.
Skin Contact:	Wash with mild soap and water.
Eye Contact:	Irritant.
Ingestion:	INDUCE VOMITING. Rinse mouth with water. Give water to dilute. Seek medical attention and contact nearest Poisons Information Center.
Carcionogen (NOHSC, NTP, IARC):	Not classified
Major Health Hazards Summary:	Irritant to eye if exposed. Gastro intestinal irritation occurs if swallowed in large doses.

Fire Fighting Measures	
Fire and Explosion Hazards:	Not flammable or explosive. However, when heated to decompostion it exerts fumes of chlorine gas.
Extinguishing Media:	Not available
Fire Fighting Instructions:	Wear full self−contained breathing apparatus. Fight fire according to the general conditions of the fire.
Flash Point:	Not available

Accidental Release Measures

Occupational Release:	Avoid slips and falls. Wear protective equipment to prevent skin, eye and respiratory system contamination. Contain the spill. Prevent any accidental release from entering stormwater drains and reaching exposed surface areas. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent . Shovel/scrape into containers for disposal. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation.

Environmental Information

Accidental Release:	Prevent any accidental release from entering stormwater drains and reaching exposed surface areas.
Environmental Risk Rating (EU Rating):	Not available
Environmental Toxicity:	Not available
Disposal Considerations:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent. Shovel absorbent into suitable, sealable, labelled drum for disposal.

Toxicological Information

Ingredients	***CAS Number***	***Proportion***
KCL	7447−40−7	100%

Individual Ingredient Information

KCL

Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available

Physical and Chemical Properties

Physical State:	Solid (powder)	Specific Gravity:	1.98.
Colour:	White	Water Solubility:	100% soluble
Odour:	Not available	pH:	Not available
Boiling Point:	1500° C.	Volatility:	Not available
Freezing Point:	733° C	Odour Threshold:	Not available
Vapour Pressure:	Not available	Evaporation Rate:	Not available
Vapour Density:	Not available	Coefficient of Water/Oil Distrib:	Not available

Stability and Reactivity

Reactivity:	Not available
Conditions to Avoid:	Not available
Incompatibilities:	Not available
Hazardous Decomposition:	Not available
Polymerization:	Not available

Transport Information

ADG Code:	Not allocated
Hazchem Code:	Not allocated
Special Provision:	Not allocated
Packaging Group:	0
Packaging Method:	Not allocated

Regulatory Information

Significant Legislation:	Not available

Other Information

Contact Point:	Australian Mud Company Phone +61 8 9445 4000 mobile 0409 114 627
Other Information:	The information presented in this MSDS was obtained from recognised published data and is as accurate as possible. Since Australian Mud Company Pty Ltd cannot anticipate the conditions under which this information may be used, it is the user's responsibility to review the information in the context of the specific intended application an to comply with the federal, state and local government regulations controlling the disposal of the product.

AMC FS2000

Hazard Alert Code: NIL

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AMC FS2000

PRODUCT USE
Drilling additive.

SUPPLIER

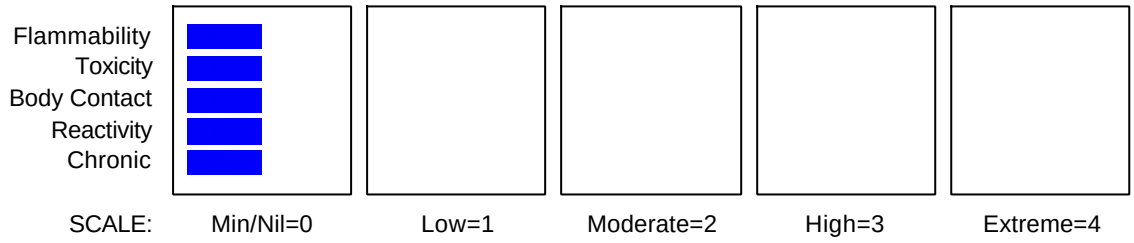
Company: AMC
Address:
5 Pitino Court
Osborne Park
WA, 6017
Australia
Telephone: 61 8 9445 4000
Emergency Tel: **61 400 966 951**
Fax: 61 8 9445 4040

Company: AMC
Address:
PO Box 1141
Osborne Park
WA, 6916
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



RISK
•None under normal operating conditions.

SAFETY
•None under normal operating conditions.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
carrier fluid		30-60
anionic water soluble polymer		30-60
activators, emulsifiers and neutralisers		balance

continued...

Section 4 - FIRST AID MEASURES

SWALLOWED
• Immediately give a glass of water.
• First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

EYE
■ If this product comes in contact with eyes:
• Wash out immediately with water.
• If irritation continues, seek medical attention.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin or hair contact occurs:
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED
• If fumes or combustion products are inhaled remove from contaminated area.
• Other measures are usually unnecessary.

NOTES TO PHYSICIAN
■ Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• There is no restriction on the type of extinguisher which may be used.
• Use extinguishing media suitable for surrounding area.

FIRE FIGHTING
• Use water delivered as a fine spray to control fire and cool adjacent area.
• Do not approach containers suspected to be hot.
• Cool fire exposed containers with water spray from a protected location.
• If safe to do so, remove containers from path of fire.

FIRE/EXPLOSION HAZARD
• Non combustible.
• Not considered a significant fire risk, however containers may burn.

FIRE INCOMPATIBILITY
■ None known.

HAZCHEM
None

PERSONAL PROTECTION
Glasses:
Chemical goggles.

Gloves:
When handling larger quantities:

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
• Clean up all spills immediately.
• Avoid breathing vapours and contact with skin and eyes.
• Control personal contact by using protective equipment.
• Contain and absorb spill with sand, earth, inert material or vermiculite.

continued...

MAJOR SPILLS
Very slippery when spilled.
Do not use water initially, apply absorbent material such as sand, earth, sawdust or vermiculite then shovel into suitable container for removal.
Then use large amounts of water to remove traces of the material
[AMC]

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Limit all unnecessary personal contact.
• Wear protective clothing when risk of exposure occurs.
• Use in a well-ventilated area.
• Avoid contact with incompatible materials.

SUITABLE CONTAINER
20 kg plastic drums.

STORAGE INCOMPATIBILITY
■ Avoid contamination of water, foodstuffs, feed or seed.

STORAGE REQUIREMENTS
• Store in original containers.
• Keep containers securely sealed.
• Store in a cool, dry, well-ventilated area.
• Store away from incompatible materials and foodstuff containers.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

PERSONAL PROTECTION


EYE
• Safety glasses with side shields
• Chemical goggles.
• Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET
■ Wear general protective gloves, eg. light weight rubber gloves.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
• frequency and duration of contact,
• chemical resistance of glove material,
• glove thickness and
• dexterity.

continued...

OTHER
■ No special equipment needed when handling small quantities.
OTHERWISE:
• Overalls.
• Barrier cream.
• Eyewash unit.

ENGINEERING CONTROLS
■ General exhaust is adequate under normal operating conditions. If risk of overexposure exists, wear SAA approved respirator.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Milky viscous liquid with a solvent odour; dispersible in water.

PHYSICAL PROPERTIES
Liquid.

State	Liquid	Molecular Weight	Not Applicable
Melting Range (°C)	Not Available	Viscosity	Not Available
Boiling Range (°C)	Not Available	Solubility in water (g/L)	Partly Miscible
Flash Point (°C)	Not Applicable	pH (1% solution)	6.0- 8.0 (5g/L)
Decomposition Temp (°C)	Not Available	pH (as supplied)	Not Available
Autoignition Temp (°C)	Not Applicable	Vapour Pressure (kPa)	Not Available
Upper Explosive Limit (%)	Not Applicable	Specific Gravity (water=1)	Not Available
Lower Explosive Limit (%)	Not Applicable	Relative Vapour Density (air=1)	Not Available
Volatile Component (%vol)	Not Available	Evaporation Rate	Not Available

Section 10 - STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY
■ Product is considered stable and hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS
ACUTE HEALTH EFFECTS
• Generally not applicable.

CHRONIC HEALTH EFFECTS
• Generally not applicable.

TOXICITY AND IRRITATION
AMC FS2000:
■ Not available. Refer to individual constituents.

Section 12 - ECOLOGICAL INFORMATION

No data
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

Ecotoxicity

continued...

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
AMC FS2000	No Data Available	No Data Available		

Section 13 - DISPOSAL CONSIDERATIONS

■ Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area.
A Hierarchy of Controls seems to be common - the user should investigate:
• Reduction.
• DO NOT allow wash water from cleaning or process equipment to enter drains.
• It may be necessary to collect all wash water for treatment before disposal.
• In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
• Where in doubt contact the responsible authority.
• Recycle wherever possible.
• Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
• Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or incineration in a licenced apparatus (after admixture with suitable combustible material).
• Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:
None (ADG7)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: UN, IATA, IMDG

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE None

REGULATIONS

No data for AMC FS2000 (CW: 25-1951)

Section 16 - OTHER INFORMATION

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

continued...

This is the end of the MSDS.

AUSTRALIAN MUD FRACSEAL (FINE)

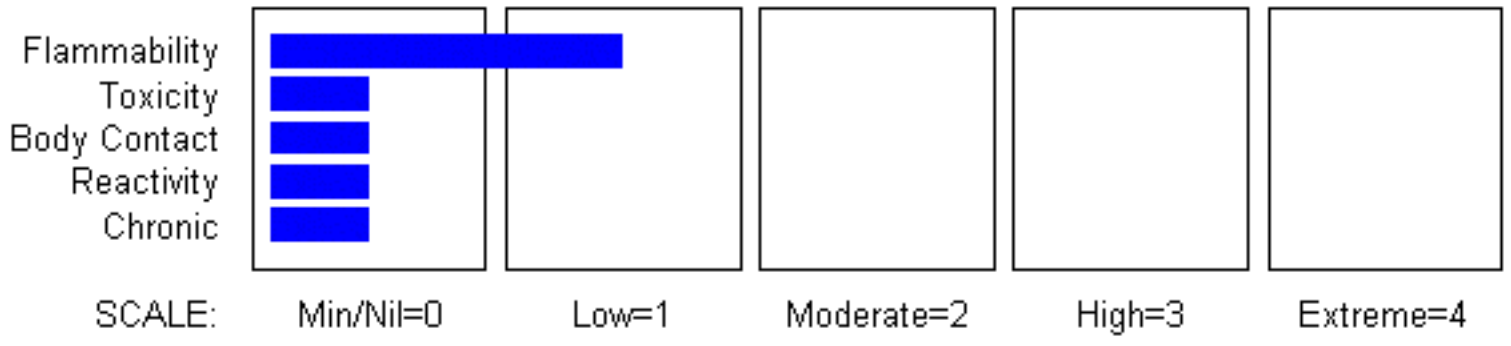
Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AUSTRALIAN MUD FRACSEAL (FINE)

PRODUCT USE
To combat lost circulation, prevention sloughing of coal, shales and unconsolidated sand, differential sticking and torque and drag reducer.

SUPPLIER
Company: Australian Mud Company Ltd
Address:
PO Box 1141
Osborne Park
WA, 6916
AUS
Telephone: +61 8 9445 4000
Emergency Tel: +61 417 824 710
Fax: +61 8 9445 4040

CHEMWATCH HAZARD RATINGS



Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to the Criteria of NOHSC, and the ADG Code.

POISONS SCHEDULE
None

RISK
None under normal operating conditions.

SAFETY
None under normal operating conditions.

continued...

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
micronised organic cellulose fiber		100

Section 4 - FIRST AID MEASURES

SWALLOWED
» ▪ Immediately give a glass of water.
▪ First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

EYE
» If this product comes in contact with eyes:
▪ Wash out immediately with water.
▪ If irritation continues, seek medical attention.
▪ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
» If skin or hair contact occurs:
▪ Flush skin and hair with running water (and soap if available).
▪ Seek medical attention in event of irritation.

INHALED
» ▪ If dust is inhaled, remove from contaminated area.
▪ Encourage patient to blow nose to ensure clear passage of breathing.
▪ If irritation or discomfort persists seek medical attention.

NOTES TO PHYSICIAN
» Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
» ▪ There is no restriction on the type of extinguisher which may be used.
▪ Use extinguishing media suitable for surrounding area.

FIRE FIGHTING
» ▪ Alert Fire Brigade and tell them location and nature of hazard.
▪ Wear breathing apparatus plus protective gloves for fire only.
▪ Prevent, by any means available, spillage from entering drains or water courses.
▪ Use fire fighting procedures suitable for surrounding area.
▪ DO NOT approach containers suspected to be hot.
▪ Cool fire exposed containers with water spray from a protected location.
▪ If safe to do so, remove containers from path of fire.
▪ Equipment should be thoroughly decontaminated after use.

FIRE/EXPLOSION HAZARD
» ▪ Solid which exhibits difficult combustion or is difficult to ignite.
▪ Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion. Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust may burn rapidly and fiercely if ignited.
▪ Dry dust can also be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust

continued...

ducts and during transport.
▪ Build-up of electrostatic charge may be prevented by bonding and grounding.
▪ Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.
▪ All movable parts coming in contact with this material should have a speed of less than 1-metre/sec.

FIRE INCOMPATIBILITY
» ▪ Avoid reaction with oxidising agents.

HAZCHEM: None

Section 6 - ACCIDENTAL RELEASE MEASURES

EMERGENCY PROCEDURES

MINOR SPILLS
» ▪ Clean up all spills immediately.
▪ Avoid contact with skin and eyes.
▪ Wear impervious gloves and safety glasses.
▪ Use dry clean up procedures and avoid generating dust.
▪ Vacuum up (consider explosion-proof machines designed to be grounded during storage and use).
▪ Do NOT use air hoses for cleaning
▪ Place spilled material in clean, dry, sealable, labelled container.

MAJOR SPILLS
» ▪ Clear area of personnel and move upwind.
▪ Alert Fire Brigade and tell them location and nature of hazard.
▪ Control personal contact by using protective equipment and dust respirator.
▪ Prevent spillage from entering drains, sewers or water courses.
▪ Avoid generating dust.
▪ Sweep, shovel up. Recover product wherever possible.
▪ Put residues in labelled plastic bags or other containers for disposal.
▪ If contamination of drains or waterways occurs, advise emergency services.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
» ▪ Limit all unnecessary personal contact.
▪ Wear protective clothing when risk of exposure occurs.
▪ Use in a well-ventilated area.
▪ Avoid contact with incompatible materials.
▪ When handling, DO NOT eat, drink or smoke.
▪ Keep containers securely sealed when not in use.
▪ Avoid physical damage to containers.
▪ Always wash hands with soap and water after handling.
▪ Work clothes should be laundered separately.
▪ Use good occupational work practice.
▪ Observe manufacturer's storing and handling recommendations.
▪ Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions

continued...

are maintained.

SUITABLE CONTAINER

» ▪ Lined metal can, lined metal pail/ can.
▪ Plastic pail.
▪ Polyliner drum.
▪ Packing as recommended by manufacturer.
▪ Check all containers are clearly labelled and free from leaks.

STORAGE INCOMPATIBILITY

» ▪ Avoid reaction with oxidising agents.

STORAGE REQUIREMENTS

» ▪ Store in original containers.
▪ Keep containers securely sealed.
▪ Store in a cool, dry, well-ventilated area.
▪ Store away from incompatible materials and foodstuff containers.
▪ Protect containers against physical damage and check regularly for leaks.
▪ Observe manufacturer's storing and handling recommendations.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

+	+	+	+	X	+

+: May be stored together
O: May be stored together with specific preventions
X: Must not be stored together

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

MATERIAL DATA

» Not available. Refer to individual constituents.

PERSONAL PROTECTION



EYE

» ▪ Safety glasses with side shields
▪ Chemical goggles.
▪ Contact lenses may pose a special hazard; soft contact lenses may absorb and

continued...

concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET

» Suitability and durability of glove type is dependent on usage. Factors such as:
- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity,

are important in the selection of gloves.
Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.
- polychloroprene
- nitrile rubber
- butyl rubber
- fluorocaoutchouc
- polyvinyl chloride

Gloves should be examined for wear and/ or degradation constantly.

OTHER

» No special equipment needed when handling small quantities.
OTHERWISE:
- Overalls.
- Barrier cream.
- Eyewash unit.

» - Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory . These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

RESPIRATOR

Protection Factor	Half- Face Respirator	Full- Face Respirator	Powered Air Respirator
10 x ES	P1 Air- line*	- -	PAPR- P1 -
50 x ES	Air- line**	P2	PAPR- P2
100 x ES	-	P3	-
		Air- line*	-
100+ x ES	-	Air- line**	PAPR- P3

continued...

* - Negative pressure demand ** - Continuous flow.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required. For further information consult site specific CHEMWATCH data (if available), or your Occupational Health and Safety Advisor.

ENGINEERING CONTROLS

» ▪ Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
▪ If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered.
Such protection might consist of:
(a): particle dust respirators, if necessary, combined with an absorption cartridge;
(b): filter respirators with absorption cartridge or canister of the right type;
(c): fresh-air hoods or masks.
Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:	Air Speed:
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1- 2.5 m/s (200- 500 f/min.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5- 10 m/s (500- 2000 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favourable to capture	1: Disturbing room air currents
2: Contaminants of low toxicity or of nuisance value only.	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	4: Small hood- local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 4-10 m/s (800-2000 f/min) for extraction of crusher dusts generated 2 metres distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

continued...

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Light brown odourless fibrous powder; insoluble in water.

PHYSICAL PROPERTIES
Does not mix with water.
Floats on water.

Molecular Weight: Not Applicable
Melting Range (°C): Not Available
Solubility in water (g/L): Immiscible
pH (1% solution): 6.5- 7.5
Volatile Component (%vol): Not Available
Relative Vapour Density (air=1): Not Applicable
Lower Explosive Limit (%): Not Available
Autoignition Temp (°C): Not Available
State: Divided Solid

Boiling Range (°C): Not Applicable
Specific Gravity (water=1): 0.9
pH (as supplied): Not Applicable
Vapour Pressure (kPa): Not Applicable
Evaporation Rate: Not Applicable
Flash Point (°C): Not Available

Upper Explosive Limit (%): Not Available
Decomposition Temp (°C): Not Available
Viscosity: Not Applicable

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY
» Product is considered stable and hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED
» The material has NOT been classified by EC Directives or other classification systems as "harmful by ingestion". This is because of the lack of corroborating animal or human evidence. The material may still be damaging to the health of the individual, following ingestion, especially where pre-existing organ (eg. liver, kidney) damage is evident. Present definitions of harmful or toxic substances are generally based on doses producing mortality rather than those producing morbidity (disease, ill-health). Gastrointestinal tract discomfort may produce nausea and vomiting. In an occupational setting however, ingestion of insignificant quantities is not thought to be cause for concern.

EYE
» Although the material is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may cause transient discomfort characterised by tearing or conjunctival redness (as with windburn). Slight abrasive damage may also result. The material may produce foreign body irritation in certain individuals.

SKIN
» The material is not thought to produce adverse health effects or skin irritation following contact (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational

continued...

setting.

INHALED
» The material is not thought to produce adverse health effects or irritation of the respiratory tract (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting.
Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.

CHRONIC HEALTH EFFECTS
» Long-term exposure to the product is not thought to produce chronic effects adverse to the health (as classified by EC Directives using animal models); nevertheless exposure by all routes should be minimised as a matter of course.
Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.

TOXICITY AND IRRITATION
» Not available. Refer to individual constituents.

Section 12 - ECOLOGICAL INFORMATION

No data

Section 13 - DISPOSAL CONSIDERATIONS

» ▪ Recycle wherever possible or consult manufacturer for recycling options.
▪ Consult State Land Waste Management Authority for disposal.
▪ Bury residue in an authorised landfill.
▪ Recycle containers if possible, or dispose of in an authorised landfill.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM: None (ADG6)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: UN, IATA, IMDG

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE: None

REGULATIONS
Australian Mud Fracseal (Fine) (CAS: None):
No regulations applicable

continued...

Section 16 - OTHER INFORMATION

» Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

» The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

Issue Date: 1-Apr-2008
Print Date: 7-Nov-2008

MATERIAL SAFETY DATA SHEET

AMC DEFOAMER

NOT HAZARDOUS*

Substance:	AMC Defoamer	Approved Criteria Classification:	Not allocated
Trade Names:	Not allocated	SUSDP Classification:	Not allocated
Product Use:	Drilling fluids compound. De−foamer. Change of Revision due to document review only.	ADG:	Not allocated
Creation Date:	7−Sep−1999	UN Number:	Not allocated
Revision Date:	21−Mar−2006		

* According to the criteria of NOHSC

Quick Summary*

General Properties:	Liquid, Colourless, Not available
Major Health Hazards:	Irritating to the eyes and skin. May cause gastric irritation. Prolonged exposure to vapours may cause irritation and nausea.
PPE:	
Extinguishing Media:	Not available
Environment:	Slippery when wet. Avoid slips and falls. Wear protective equipment to prevent skin, eye and respiratory system contamination. Contain the spill. Prevent any accidental release from entering stormwater drains and reaching exposed surface areas. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent . Shovel/scrape into containers for disposal. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation.
Disposal:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent. Shovel absorbent into suitable, sealable, labelled drum for disposal.

Handling and Storage

Storage:	Store in a dry cool area. Keep containers closed.
Exposure Limits:	OSHA PEL AGGTH TLV 2.5mg/m3 2.5mg/m3
Ventilation:	Normal ventilation is adequate. Always use in well ventilated areas.
Eye Protection:	
Skin Protection:	 Rubber

Repiratory Protection:	 (AS1715, AS1716)
Protective Material Types:	

First Aid Measures

Scheduled Poisons:	Not allocated
Inhalation:	Removed the person to fresh air.
Skin Contact:	Wash with mild soap and water.
Eye Contact:	Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Seek immediate medical assistance.
Ingestion:	Seek medical attention.

Potential Health Effects

Inhalation:	Prolonged exposure to vapours or mist may cause irritation and nausea.
Skin Contact:	Wash with mild soap and water.
Eye Contact:	Irritating to the eyes.
Ingestion:	Seek medical attention.
Carcionogen (NOHSC, NTP, IARC):	None classified
Major Health Hazards Summary:	Irritating to the eyes and skin. May cause gastric irritation. Prolonged exposure to vapours may cause irritation and nausea.

Fire Fighting Measures

Fire and Explosion Hazards:	Not flammable under conditions of use.
Extinguishing Media:	Not available
Fire Fighting Instructions:	Wear self contained breathing apparatus.
Flash Point:	110 ° C

Accidental Release Measures

Occupational Release:	Slippery when wet. Avoid slips and falls. Wear protective equipment to prevent skin, eye and respiratory system contamination. Contain the spill. Prevent any accidental release from entering stormwater drains and reaching exposed surface areas. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent . Shovel/scrape into containers for disposal. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation.

Environmental Information

Accidental Release:	Prevent spillage from entering stormwater drains or unsealed areas (see Accidental release measures).
Environmental Risk Rating (EU Rating):	Not available
Environmental Toxicity:	Not available
Disposal Considerations:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent. Shovel absorbent into suitable, sealable, labelled drum for disposal.

Toxicological Information

Ingredients	***CAS Number***	***Proportion***
Silicone	Not allocated	<40%

Diluter	Not allocated	To 100%

Individual Ingredient Information	
Silicone	
Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available
Diluter	
Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available

Physical and Chemical Properties

Physical State:	Liquid	Specific Gravity:	0.976.
Colour:	Colourless	Water Solubility:	Partially
Odour:	Not available	pH:	Not available
Boiling Point:	Not available	Volatility:	Not available
Freezing Point:	Not available	Odour Threshold:	Not available
Vapour Pressure:	Not available	Evaporation Rate:	Not available
Vapour Density:	Not available	Coefficient of Water/Oil Distrib:	Not available

Stability and Reactivity

Reactivity:	Not available
Conditions to Avoid:	Not available
Incompatibilities:	Not available
Hazardous Decomposition:	Not available
Polymerization:	Not available

Transport Information

ADG Code:	Not allocated
Hazchem Code:	Not allocated
Special Provision:	Not allocated
Packaging Group:	0
Packaging Method:	Not allocated

Regulatory Information	
Significant Legislation:	Not available

Other Information	
Contact Point:	Australian Mud Company Phone +61 8 9445 4000 mobile 0409 114 627
Other Information:	The information presented in this MSDS was obtained from recognised published data and is as accurate as possible. Since Australian Mud Company Pty Ltd cannot anticipate the conditions under which this information may be used, it is the user's responsibility to review the information in the context of the specific intended application an to comply with the federal, state and local government regulations controlling the disposal of the product.

AMC HD-SPERSE

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AMC HD-SPERSE

PRODUCT USE
Antiscalant.

SUPPLIER

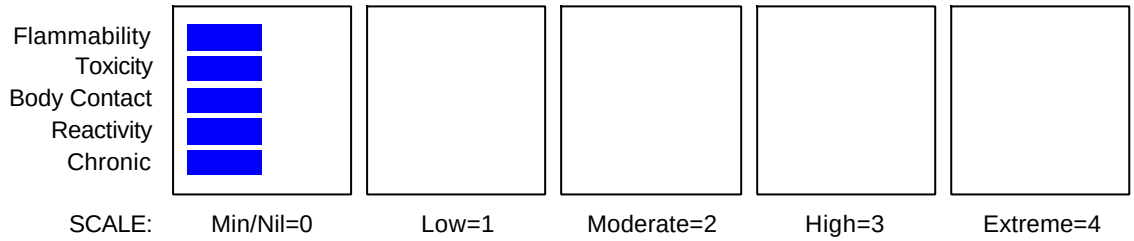
Company: AMC
Address:
5 Pitino Court
Osborne Park
WA, 6017
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Company: AMC
Address:
PO Box 1141
Osborne Park
WA, 6916
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



RISK
•None under normal operating conditions.

SAFETY
•None under normal operating conditions.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
anionic acrylic polymer		N/S

Section 4 - FIRST AID MEASURES

SWALLOWED
• If swallowed do NOT induce vomiting.
• If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

continued...

• Observe the patient carefully.
• Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

EYE
■ If this product comes in contact with the eyes:
• Wash out immediately with fresh running water.
• Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
• Seek medical attention without delay; if pain persists or recurs seek medical attention.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin contact occurs:
• Immediately remove all contaminated clothing, including footwear.
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED
• If fumes or combustion products are inhaled remove from contaminated area.
• Other measures are usually unnecessary.

NOTES TO PHYSICIAN
■ Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• There is no restriction on the type of extinguisher which may be used.
• Use extinguishing media suitable for surrounding area.

FIRE FIGHTING
• Use water delivered as a fine spray to control fire and cool adjacent area.
• Do not approach containers suspected to be hot.
• Cool fire exposed containers with water spray from a protected location.
• If safe to do so, remove containers from path of fire.

FIRE/EXPLOSION HAZARD
• Non combustible.
• Not considered a significant fire risk, however containers may burn.
Decomposes on heating and produces toxic fumes of: carbon dioxide (CO_2), other pyrolysis products typical of burning organic material.

FIRE INCOMPATIBILITY
■ None known.

HAZCHEM
None

PERSONAL PROTECTION
Glasses:
Chemical goggles.

Gloves:
When handling larger quantities:

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
• Clean up all spills immediately.
• Avoid breathing vapours and contact with skin and eyes.
• Control personal contact by using protective equipment.
• Contain and absorb spill with sand, earth, inert material or vermiculite.

MAJOR SPILLS
• Clear area of personnel and move upwind.
• Alert Fire Brigade and tell them location and nature of hazard.
• Control personal contact by using protective equipment.
• Prevent spillage from entering drains, sewers or water courses.

continued...

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Limit all unnecessary personal contact.
• Wear protective clothing when risk of exposure occurs.
• Use in a well-ventilated area.
• Avoid contact with incompatible materials.

SUITABLE CONTAINER
• Polyethylene or polypropylene container.
• Packing as recommended by manufacturer.
• Check all containers are clearly labelled and free from leaks.

STORAGE INCOMPATIBILITY
■ Avoid contamination of water, foodstuffs, feed or seed.

STORAGE REQUIREMENTS
• Store in original containers.
• Keep containers securely sealed.
• Store in a cool, dry, well-ventilated area.
• Store away from incompatible materials and foodstuff containers.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

PERSONAL PROTECTION


EYE
• Safety glasses with side shields
• Chemical goggles.
• Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET
■ Wear general protective gloves, eg. light weight rubber gloves.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
• frequency and duration of contact,
• chemical resistance of glove material,
• glove thickness and
• dexterity.

OTHER
■ No special equipment needed when handling small quantities.
OTHERWISE:
• Overalls.
• Barrier cream.
• Eyewash unit.

continued...

ENGINEERING CONTROLS
■ General exhaust is adequate under normal operating conditions. If risk of overexposure exists, wear SAA approved respirator.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Colourless liquid with a sulfur-like odour; mixes with water.

PHYSICAL PROPERTIES
Liquid.
Mixes with water.

State	Liquid	Molecular Weight	Not Applicable
Melting Range (°C)	Not Available	Viscosity	Not Available
Boiling Range (°C)	~103	Solubility in water (g/L)	Miscible
Flash Point (°C)	Not Applicable	pH (1% solution)	Not Available
Decomposition Temp (°C)	Not Available	pH (as supplied)	8.5
Autoignition Temp (°C)	Not Applicable	Vapour Pressure (kPa)	Not Available
Upper Explosive Limit (%)	Not Applicable	Specific Gravity (water=1)	~1.3
Lower Explosive Limit (%)	Not Applicable	Relative Vapour Density (air=1)	Not Available
Volatile Component (%vol)	Not Available	Evaporation Rate	Not Available

Section 10 - STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY
• Presence of incompatible materials.
• Product is considered stable.
• Hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS
ACUTE HEALTH EFFECTS
■ Not applicable.

CHRONIC HEALTH EFFECTS
■ Not applicable.

TOXICITY AND IRRITATION
AMC HD-SPERSE:
■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY
Oral (Rat) LD50: >2000 mg/kg

IRRITATION

Section 12 - ECOLOGICAL INFORMATION

No data
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

continued...

Section 13 - DISPOSAL CONSIDERATIONS

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or incineration in a licenced apparatus (after admixture with suitable combustible material).
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:
None (ADG7)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: UN, IATA, IMDG

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE None

REGULATIONS

No data for AMC HD-Sperse (CW: 02-1328)

Section 16 - OTHER INFORMATION

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Issue Date: 7-May-2009
Print Date: 28-Jan-2011

This is the end of the MSDS.

AMC CR-650

Hazard Alert Code: NIL

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AMC CR-650

PRODUCT USE
Drilling fluid additive.

SUPPLIER

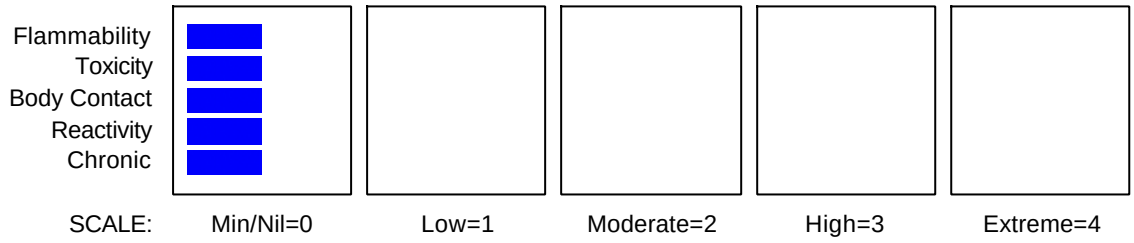
Company: AMC
Address:
5 Pitino Court
Osborne Park
WA, 6017
Australia
Telephone: 61 8 9445 4000
Emergency Tel: **61 400 966 951**
Fax: 61 8 9445 4040

Company: AMC
Address:
PO Box 1141
Osborne Park
WA, 6916
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



RISK
•None under normal operating conditions.

SAFETY
•None under normal operating conditions.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
acrylic acid/ acrylamide copolymer, sodium salt	25987-30-8	Not Spec
drilling fluid additive		Not Spec

continued...

Section 4 - FIRST AID MEASURES

SWALLOWED
• If swallowed do NOT induce vomiting.
• If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
• Observe the patient carefully.
• Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

EYE
■ If this product comes in contact with eyes:
• Wash out immediately with water.
• If irritation continues, seek medical attention.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin or hair contact occurs:
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED
• If dust is inhaled, remove from contaminated area.
• Encourage patient to blow nose to ensure clear passage of breathing.
• If irritation or discomfort persists seek medical attention.

NOTES TO PHYSICIAN
■ Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• There is no restriction on the type of extinguisher which may be used.
• Use extinguishing media suitable for surrounding area.

FIRE FIGHTING
• Alert Fire Brigade and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves for fire only.
• Prevent, by any means available, spillage from entering drains or water courses.
• Use fire fighting procedures suitable for surrounding area.

FIRE/EXPLOSION HAZARD
• Non combustible.
• Not considered a significant fire risk, however containers may burn.

FIRE INCOMPATIBILITY
■ None known.

HAZCHEM
None

PERSONAL PROTECTION

Glasses:	Gloves:	Respirator:
Chemical goggles.	When handling larger quantities:	Particulate

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
• Clean up all spills immediately.
• Avoid contact with skin and eyes.
• Wear impervious gloves and safety glasses.

continued...

• Use dry clean up procedures and avoid generating dust.

MAJOR SPILLS
• Clear area of personnel and move upwind.
• Alert Fire Brigade and tell them location and nature of hazard.
• Control personal contact by using protective equipment and dust respirator.
• Prevent spillage from entering drains, sewers or water courses.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Limit all unnecessary personal contact.
• Wear protective clothing when risk of exposure occurs.
• Use in a well-ventilated area.
• Avoid contact with incompatible materials.

SUITABLE CONTAINER
• Lined metal can, lined metal pail/ can.
• Plastic pail.
• Polyliner drum.
• Packing as recommended by manufacturer.

STORAGE INCOMPATIBILITY
■ Avoid contamination of water, foodstuffs, feed or seed.

STORAGE REQUIREMENTS
• Store in original containers.
• Keep containers securely sealed.
• Store in a cool, dry, well-ventilated area.
• Store away from incompatible materials and foodstuff containers.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS
The following materials had no OELs on our records
• acrylic acid/ acrylamide copolymer, sodium salt: CAS:25987- 30- 8 CAS:25085- 02- 3

PERSONAL PROTECTION



RESPIRATOR
• particulate.

EYE
• Safety glasses with side shields
• Chemical goggles.
• Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed

continued...

hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET
■ Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
• frequency and duration of contact,
• chemical resistance of glove material,
• glove thickness and
• dexterity.
Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.
• polychloroprene
• nitrile rubber
• butyl rubber
• fluorocaoutchouc.

OTHER
■ No special equipment needed when handling small quantities.
OTHERWISE:
• Overalls.
• Barrier cream.
• Eyewash unit.

ENGINEERING CONTROLS
• Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
• If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered.
Such protection might consist of:
(a): particle dust respirators, if necessary, combined with an absorption cartridge;
(b): filter respirators with absorption cartridge or canister of the right type;
(c): fresh-air hoods or masks.
Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Fine granular free-flowing solid; soluble in water.

PHYSICAL PROPERTIES
Mixes with water.

State	Divided Solid	Molecular Weight	Not Applicable
Melting Range (°C)	Not Available	Viscosity	Not Applicable
Boiling Range (°C)	Not Applicable	Solubility in water (g/L)	Miscible
Flash Point (°C)	Not Applicable	pH (1% solution)	~7.5 (5% sol)
Decomposition Temp (°C)	Not Available	pH (as supplied)	Not Applicable
Autoignition Temp (°C)	Not Applicable	Vapour Pressure (kPa)	Not Applicable
Upper Explosive Limit (%)	Not Applicable	Specific Gravity (water=1)	0.7- 0.8
Lower Explosive Limit (%)	Not Applicable	Relative Vapour Density (air=1)	Not Applicable
Volatile Component (%vol)	Not Available	Evaporation Rate	Not Applicable

Section 10 - STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY
■ Product is considered stable and hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

continued...

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS
• Generally not applicable.

CHRONIC HEALTH EFFECTS
• Generally not applicable.

TOXICITY AND IRRITATION

AMC CR-650:
■ Not available. Refer to individual constituents.

ACRYLIC ACID/ ACRYLAMIDE COPOLYMER, SODIUM SALT:
■ No significant acute toxicological data identified in literature search.

Section 12 - ECOLOGICAL INFORMATION

No data
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
AMC CR- 650	No Data Available	No Data Available		
acrylic acid/ acrylamide copolymer, sodium salt	No Data Available	No Data Available		

Section 13 - DISPOSAL CONSIDERATIONS

• Recycle wherever possible or consult manufacturer for recycling options.
• Consult State Land Waste Management Authority for disposal.
• Bury residue in an authorised landfill.
• Recycle containers if possible, or dispose of in an authorised landfill.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:
None (ADG7)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: UN, IATA, IMDG

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE None

REGULATIONS

Regulations for ingredients

acrylic acid/ acrylamide copolymer, sodium salt (CAS: 25987-30-8,25085-02-3) is found on the following regulatory lists;
"Australia Inventory of Chemical Substances (AICS)"

continued...

No data for AMC CR-650 (CW: 4902-92)

Section 16 - OTHER INFORMATION

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
acrylic acid/ acrylamide copolymer, sodium salt	25987-30-8, 25085-02-3

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Issue Date: 6-May-2009
Print Date: 24-May-2011

This is the end of the MSDS.

MATERIAL SAFETY DATA SHEET

CITRIC ACID

NOT HAZARDOUS*

Substance:	Citric Acid	Approved Criteria Classification:	Not allocated
Trade Names:	Citric Acid Anhydrous, 2−Hydroxy−1,2,3−Propanetricarboxylic Acid	SUSDP Classification:	Not allocated
Product Use:	Preparation of citrates, flavouring extracts, confections, soft drinks, effervescent salts, acidifier, dispersing agent, medicines, acidulant and antioxidant in foods; sequestering agent, water conditioning agent and detergent builder; cleaning and polishing stainless steel and other metals; alkyd resins, mordant, removal of sulphur dioxide from smelter waste gases. Change of Revision due to document review only.	ADG:	Not allocated
Creation Date:	19−Jan−2000	UN Number:	0
Revision Date:	21−Mar−2006		

* According to the criteria of NOHSC

Quick Summary*

General Properties:	Solid (powder), White, Odourless
Major Health Hazards:	Potential for irritation to upper respiratory system, skin and eyes with prolonged use.
PPE:	
Extinguishing Media:	Water, foam, carbon dioxide or dry chemical.
Environment:	The powders can be swept or vacuumed up and small residues can be flushed away with copious amounts of water. Use methods of collection that avoid dust formation. Sweep up large spills with dust binding agent or use a vacuum cleaner. Waste material can be disposed of at an approved land−fill site.
Disposal:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation.

Handling and Storage

Storage:	Store in a cool, dry place. Close containers securely after use. Citric acid is an organic acid, solutions are corrosive and will slowly corrode mild steel. Avoid generating dust. Take precautionary measures against static discharges. Avoid storage or transport with oxidising agents or bases.
Exposure Limits:	None assigned. Nuisance dust exposure standard of 10mg/m3 (8 hr − TWA) should be observed.
Ventilation:	Good general ventilation. Minimise dust generation.
Eye Protection:	

Skin Protection:	 RECOMMENDED protective clothing.  Rubber or plastic
Repiratory Protection:	
Protective Material Types:	

First Aid Measures

Scheduled Poisons:	Not allocated
Inhalation:	Remove from further exposure. Seek medical attention if effects persist.
Skin Contact:	Remove all contaminated clothing and wash affected area with plenty of soap and water.
Eye Contact:	Hold eyes open and wash with water continuously for at least fifteen minutes. If irritation persists, seek medical attention.
Ingestion:	Do not induce vomiting. Rinse out mouth with water and then drink 1−3 cups of water and seek medical advice if necessary.

Potential Health Effects

Inhalation:	Inhalation of dust or powder is likely to result in respiratory irritation.
Skin Contact:	Remove all contaminated clothing and wash affected area with plenty of soap and water.
Eye Contact:	Moderately irritating.
Ingestion:	Do not induce vomiting. Rinse out mouth with water and then drink 1−3 cups of water and seek medical advice if necessary.
Carcionogen (NOHSC, NTP, IARC):	Not classified
Major Health Hazards Summary:	Potential for irritation to upper respiratory system, skin and eyes with prolonged use.

Fire Fighting Measures

Fire and Explosion Hazards:	When heated to decomposition, emits carbon oxides, acrid smoke and irritating fumes. Incompatible with strong oxidising agents or strong bases. Forms mildly acidic solutions that may react with metals, releasing hydrogen, a flammable, potentially explosive gas.
Extinguishing Media:	Water, foam, carbon dioxide or dry chemical.
Fire Fighting Instructions:	In the event of a fire wear self−contained breathing apparatus.
Flash Point:	Not available

Accidental Release Measures

Occupational Release:	The powders can be swept or vacuumed up and small residues can be flushed away with copious amounts of water. Use methods of collection that avoid dust formation. Sweep up large spills with dust binding agent or use a vacuum cleaner. Waste material can be disposed of at an approved land−fill site.

Environmental Information

Accidental Release:	Citric acid is fully biodegradable. Degradability: >98% after 2 days. COD 728mg O2/g BOD5 826mg O2/g Toxicity to Fish: LC50 440 − 706mg/L/96h (Goldfish) Toxicity to Bacteria: >10,000mg/L
Environmental Risk Rating (EU Rating):	Not available
Environmental Toxicity:	Not available

Disposal Considerations:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation.

Toxicological Information

Ingredients	***CAS Number***	***Proportion***
Citric Acid	77−92−9	>99%
Water	Not allocated	<1%

Individual Ingredient Information

Citric Acid

Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available

Water

Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available

Physical and Chemical Properties

Physical State:	Solid (powder)	Specific Gravity:	Not available
Colour:	White	Water Solubility:	567g/L @ 25° C
Odour:	Odourless	pH:	Not available
Boiling Point:	Not available	Volatility:	Not available
Freezing Point:	153 ° C	Odour Threshold:	Not available
Vapour Pressure:	Not available	Evaporation Rate:	Not available
Vapour Density:	900 − 980kg/m3	Coefficient of Water/Oil Distrib:	Not available

Stability and Reactivity

Reactivity:	Not available
Conditions to Avoid:	Not available
Incompatibilities:	Not available
Hazardous Decomposition:	Not available
Polymerization:	Not available

Transport Information

ADG Code:	Not allocated
Hazchem Code:	Not allocated
Special Provision:	Not allocated
Packaging Group:	0
Packaging Method:	Not allocated

Regulatory Information

Significant Legislation:	Not available

Other Information

Contact Point:	Australian Mud Company Phone +61 8 9445 4000 mobile 0409 114 627
Other Information:	The information presented in this MSDS was obtained from recognised published data and is as accurate as possible. Since Australian Mud Company Pty Ltd cannot anticipate the conditions under which this information may be used, it is the user's responsibility to review the information in the context of the specific intended application an to comply with the federal, state and local government regulations controlling the disposal of the product.

MATERIAL SAFETY DATA SHEET

AMC BIOCIDE G

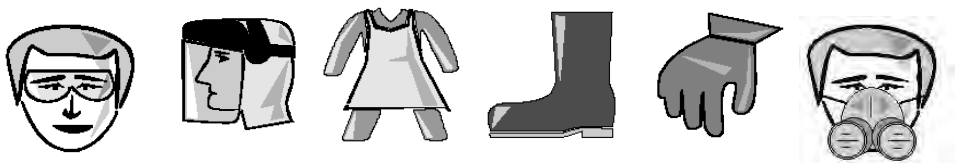
HAZARDOUS* DANGEROUS GOOD^

Substance:	AMC Biocide G	Approved Criteria Classification:	Not allocated
Trade Names:	Not allocated	SUSDP Classification:	Not allocated
Product Use:	Broad spectrum microbiocide for industrial water systems. Change of Revision due to document review only.	ADG:	6.1(b)
Creation Date:	14−May−2003	UN Number:	2810
Revision Date:	21−Mar−2006		

* According to the criteria of NOHSC

^ According to the Australian Dangerous Goods Code

Quick Summary*

General Properties:	Liquid, Clear, white, Odourless
Major Health Hazards:	May cause serious eye, skin, upper respiratory system irritation with exposure.
PPE:	
Extinguishing Media:	Not available.
Environment:	Slippery when wet. Avoid slips and falls. Wear protective equipment to prevent skin, eye and respiratory system contamination. Contain the spill. Prevent any accidental release from entering stormwater drains and reaching exposed surface areas. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent . Shovel/scrape into containers for disposal. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation.
Disposal:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent. Shovel absorbent into suitable, sealable, labelled drum for disposal.

Handling and Storage

Storage:	Keep containers tightly closed. Ensure that the product is not mixed with other materials.
Exposure Limits:	Peak limitation recommended for glutaralehyde is 0.1ppm Acute oral toxicity LD50 approx 320 mg/kg (rat) Dermal LD50 (rabbit) 2560mg/kg. Inhalation LC50 (rat) 5000mg/kg.
Ventilation:	Sufficient to maintain concentration below peak limitation. Use in areas which have good local exhaust ventilation. Cover containers. Dispose of waste water in areas that are ventilated.
Eye Protection:	 Or face shield.  Or goggles

Skin Protection:	   Elbow length. Puncture resistant nitrile, heavy neoprene and butyl rubber.
Repiratory Protection:	 RECOMMEND (AS1715,AS1716) when poor ventilation, cleanups.
Protective Material Types:	PPE should be cleaned with soap and water before re−use. Prevent skin contact.

First Aid Measures

Scheduled Poisons:	6
Inhalation:	Remove to fresh air. Seek medical attention if symptoms persist.
Skin Contact:	Wash with soap and water. Maintain good personal hygiene practises.
Eye Contact:	Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Seek immediate medical assistance.
Ingestion:	DO NOT INDUCE VOMITING. Rinse mouth with water. Give water to dilute. Seek medical attention and contact nearest Poisons Information Center.

Potential Health Effects

Inhalation:	Irritating and possibly sensitising. Harmful by inhalation.
Skin Contact:	Wash with soap and water. Maintain good personal hygiene practises.
Eye Contact:	Corrosive. Causes corneal burns. Risk of serious damage to eyes.
Ingestion:	DO NOT INDUCE VOMITING. Rinse mouth with water. Give water to dilute. Seek medical attention and contact nearest Poisons Information Center.
Carcionogen (NOHSC, NTP, IARC):	Not available.
Major Health Hazards Summary:	May cause serious eye, skin, upper respiratory system irritation with exposure.

Fire Fighting Measures

Fire and Explosion Hazards:	Not flammable or combustible.
Extinguishing Media:	Not available.
Fire Fighting Instructions:	Wear full protective clothing.
Flash Point:	Not available

Accidental Release Measures

Occupational Release:	Slippery when wet. Avoid slips and falls. Wear protective equipment to prevent skin, eye and respiratory system contamination. Contain the spill. Prevent any accidental release from entering stormwater drains and reaching exposed surface areas. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent . Shovel/scrape into containers for disposal. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation.

Environmental Information

Accidental Release:	Prevent any accidental release from entering stormwater drains and reaching exposed surface areas.
Environmental Risk Rating (EU Rating):	Not available
Environmental Toxicity:	Not available

Disposal Considerations:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent. Shovel absorbent into suitable, sealable, labelled drum for disposal.

Toxicological Information

Ingredients	***CAS Number***	***Proportion***
Glutaralehyde	111−30−8	10% to 30%
Water	7732−18−5	To 100%

Individual Ingredient Information	
Glutaralehyde	
Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available
Water	
Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available

Physical and Chemical Properties

Physical State:	Liquid	Specific Gravity:	1.02
Colour:	Clear, white	Water Solubility:	Miscible
Odour:	Odourless	pH:	Not available
Boiling Point:	100° C	Volatility:	Not available
Freezing Point:	Not available	Odour Threshold:	Not available
Vapour Pressure:	Not available	Evaporation Rate:	Not available
Vapour Density:	Not available	Coefficient of Water/Oil Distrib:	Not available

Stability and Reactivity

Reactivity:	Not available
Conditions to Avoid:	Not available
Incompatibilities:	Not available
Hazardous Decomposition:	Not available
Polymerization:	Not available

Transport Information

ADG Code:	6.1(b)
Hazchem Code:	2[Z]
Special Provision:	Not allocated
Packaging Group:	III
Packaging Method:	Not allocated

Regulatory Information

Significant Legislation:	Not available

Other Information

Contact Point:	Australian Mud Company Phone +61 8 9445 4000 mobile 0409 114 627
Other Information:	The information presented in this MSDS was obtained from recognised published data and is as accurate as possible. Since Australian Mud Company Pty Ltd cannot anticipate the conditions under which this information may be used, it is the user's responsibility to review the information in the context of the specific intended application an to comply with the federal, state and local government regulations controlling the disposal of the product.

MATERIAL SAFETY DATA SHEET

BIO−VIS

NOT HAZARDOUS*

Substance:	Bio−Vis	Approved Criteria Classification:	Not allocated
Trade Names:	Not allocated	SUSDP Classification:	Not allocated
Product Use:	Drilling fluids compound, drilling viscosifier. Change of Revision due to document review only.	ADG:	Not allocated
Creation Date:	7−Sep−1999	UN Number:	0
Revision Date:	21−Mar−2006		

* According to the criteria of NOHSC

Quick Summary*

General Properties:	Solid (powder), Cream, Odourless
Major Health Hazards:	Breathing high concentrations may cause irritation of the nose, throat and upper respiratory system. May cause mechanical eye irritation if dust is excessive.
PPE:	
Extinguishing Media:	Carbon dioxide, foam, dry chemicals.
Environment:	Slippery when wet. Avoid slips and falls. Wear protective equipment to prevent skin and eye contamination. Contain the spill. Prevent any accidental release from entering stormwater drains and reaching exposed surface areas. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent . Shovel/scrape into containers for disposal. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation.
Disposal:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent. Shovel absorbent into suitable, sealable, labelled drum for disposal.

Handling and Storage

Storage:	Store in a dry area. Keep dust to a minimum. Product slippery when wet.
Exposure Limits:	No exposure limit has been established but the following should be considered: ACGIH TLV−TWA for nuisance dust: = 10 mg/m³ total dust, or 5mg/m3 for respirable dust.
Ventilation:	Use in a well ventilated area.

Eye Protection:	
Skin Protection:	 Rubber or cotton.
Repiratory Protection:	 (AS1715, AS1716)
Protective Material Types:	

First Aid Measures	
Scheduled Poisons:	Not allocated
Inhalation:	Remove to fresh air.
Skin Contact:	Wash with mild soap and water.
Eye Contact:	Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Seek immediate medical assistance.
Ingestion:	DO NOT INDUCE VOMITING. Drink water to dilute.

Potential Health Effects	
Inhalation:	Non irritating to mucous membranes. However, breathing high concentrations may cause irritation of the nose, throat and upper respiratory system.
Skin Contact:	Wash with mild soap and water.
Eye Contact:	May cause mechanical eye irritation if dust is excessive.
Ingestion:	DO NOT INDUCE VOMITING. Drink water to dilute.
Carcionogen (NOHSC, NTP, IARC):	Not classified
Major Health Hazards Summary:	Breathing high concentrations may cause irritation of the nose, throat and upper respiratory system. May cause mechanical eye irritation if dust is excessive.

Fire Fighting Measures	
Fire and Explosion Hazards:	Not flammable or explosive. Treat as a flammable dust in a finely divided and suspended state.
Extinguishing Media:	Carbon dioxide, foam, dry chemicals.
Fire Fighting Instructions:	Not available
Flash Point:	Not available

Accidental Release Measures

Occupational Release:	Slippery when wet. Avoid slips and falls. Wear protective equipment to prevent skin and eye contamination. Contain the spill. Prevent any accidental release from entering stormwater drains and reaching exposed surface areas. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent . Shovel/scrape into containers for disposal. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation.

Environmental Information

Accidental Release:	Prevent any accidental release from entering stormwater drains and reaching exposed surface areas.
Environmental Risk Rating (EU Rating):	Not available
Environmental Toxicity:	Not available
Disposal Considerations:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent. Shovel absorbent into suitable, sealable, labelled drum for disposal.

Toxicological Information

Ingredients	***CAS Number***	***Proportion***
Blend of polysaccharide polymers	Not allocated	100%

Individual Ingredient Information

Blend of polysaccharide polymers

Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available

Physical and Chemical Properties

Physical State:	Solid (powder)	Specific Gravity:	1.55−1.60.
Colour:	Cream	Water Solubility:	85−90%.
Odour:	Odourless	pH:	Not available
Boiling Point:	Not available	Volatility:	Not available
Freezing Point:	Not available	Odour Threshold:	Not available
Vapour Pressure:	Not available	Evaporation Rate:	Not available
Vapour Density:	Not available	Coefficient of Water/Oil Distrib:	Not available

Stability and Reactivity

Reactivity:	Not available
Conditions to Avoid:	Not available
Incompatibilities:	Not available
Hazardous Decomposition:	Not available
Polymerization:	Not available

Transport Information

ADG Code:	Not allocated
Hazchem Code:	Not allocated
Special Provision:	Not allocated
Packaging Group:	0
Packaging Method:	Not allocated

Regulatory Information

Significant Legislation:	Not available

Other Information

Contact Point:	Australian Mud Company Phone +61 8 9445 4000 mobile 0409 114 627
Other Information:	The information presented in this MSDS was obtained from recognised published data and is as accurate as possible. Since Australian Mud Company Pty Ltd cannot anticipate the conditions under which this information may be used, it is the user's responsibility to review the information in the context of the specific intended application an to comply with the federal, state and local government regulations controlling the disposal of the product.

MATERIAL SAFETY DATA SHEET

BARYTE

HAZARDOUS*

Substance:	Baryte	Approved Criteria Classification:	Not allocated
Trade Names:	Barium sulphate, barite	SUSDP Classification:	Not allocated
Product Use:	Drilling fluids compound weighting material. Change of Revision due to document review only.	ADG:	Not allocated
Creation Date:	17−Sep−1999	UN Number:	0
Revision Date:	21−Mar−2006		

* According to the criteria of NOHSC

Quick Summary*

General Properties:	Solid (powder), White/Grey/Tan, Odourless
Major Health Hazards:	Prolonged inhalation of silica dust has been know to cause silicosis and other effects.
PPE:	
Extinguishing Media:	Carbon dioxide, foam, dry chemicals, water.
Environment:	Slippery when wet. Avoid slips and falls. Wear protective equipment to prevent skin and eye contamination. Contain the spill. Prevent any accidental release from entering stormwater drains and reaching exposed surface areas. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent . Shovel/scrape into containers for disposal. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation.
Disposal:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent. Shovel absorbent into suitable, sealable, labelled drum for disposal.

Handling and Storage

Storage:	Store in a dry area. Keep dust to a minimum. Product slippery when wet.
Exposure Limits:	Treat as a nuisance dust. TWA = 10 mg/m³ For barium sulphate containing no asbestos and < 1% crystalline silica as quarts.
Ventilation:	Use in a well ventilated area.

Eye Protection:	
Skin Protection:	 RECOMMENDED Rubber
Repiratory Protection:	 (AS1715, AS 1716)
Protective Material Types:	RECOMMENDED: Barrier cream. Wear loose comfortable clothing. Avoid generating dust and clean work area regularly.

First Aid Measures

Scheduled Poisons:	Not allocated
Inhalation:	Remove to fresh air.
Skin Contact:	Wash with soap and water.
Eye Contact:	Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Seek immediate medical assistance.
Ingestion:	INDUCE VOMITING. Rinse mouth with water. Give water to dilute. Seek medical attention and contact nearest Poisons Information Center.

Potential Health Effects

Inhalation:	Prolonged inhalation of silica dust has been know to cause silicosis and other effects.
Skin Contact:	Wash with soap and water.
Eye Contact:	May cause mechanical eye irritation if dust is excessive.
Ingestion:	INDUCE VOMITING. Rinse mouth with water. Give water to dilute. Seek medical attention and contact nearest Poisons Information Center.
Carcionogen (NOHSC, NTP, IARC):	Prolonged inhalation of silica dust has been know to cause silicosis and other effects.
Major Health Hazards Summary:	Prolonged inhalation of silica dust has been know to cause silicosis and other effects.

Fire Fighting Measures

Fire and Explosion Hazards:	Not flammable or explosive.
Extinguishing Media:	Carbon dioxide, foam, dry chemicals, water.
Fire Fighting Instructions:	Not available
Flash Point:	Not available

Accidental Release Measures	
Occupational Release:	Slippery when wet. Avoid slips and falls. Wear protective equipment to prevent skin and eye contamination. Contain the spill. Prevent any accidental release from entering stormwater drains and reaching exposed surface areas. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent . Shovel/scrape into containers for disposal. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation.

Environmental Information	
Accidental Release:	Prevent any accidental release from entering stormwater drains and reaching exposed surface areas.
Environmental Risk Rating (EU Rating):	Not available
Environmental Toxicity:	Not available
Disposal Considerations:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent. Shovel absorbent into suitable, sealable, labelled drum for disposal.

Toxicological Information		
Ingredients	***CAS Number***	***Proportion***
Barium sulphate	7727−43−73	95%
Silica (Quartz)	14808−60−7	5%

Individual Ingredient Information	
Barium sulphate	
Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available
Silica (Quartz)	
Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available

Physical and Chemical Properties			
Physical State:	Solid (powder)	Specific Gravity:	4.20−4.25.
Colour:	White/Grey/Tan	Water Solubility:	Insoluble
Odour:	Odourless	pH:	Not available
Boiling Point:	Not available	Volatility:	Not available
Freezing Point:	Not available	Odour Threshold:	Not available
Vapour Pressure:	Not available	Evaporation Rate:	Not available
Vapour Density:	Not available	Coefficient of Water/Oil Distrib:	Not available

Stability and Reactivity	
Reactivity:	Not available
Conditions to Avoid:	Not available
Incompatibilities:	Not available
Hazardous Decomposition:	Not available
Polymerization:	Not available

Transport Information	
ADG Code:	Not allocated
Hazchem Code:	Not allocated
Special Provision:	Not allocated
Packaging Group:	0
Packaging Method:	Not allocated

Regulatory Information	
Significant Legislation:	Not available

Other Information	
Contact Point:	Australian Mud Company Phone +61 8 9445 4000 mobile 0409 114 627
Other Information:	The information presented in this MSDS was obtained from recognised published data and is as accurate as possible. Since Australian Mud Company Pty Ltd cannot anticipate the conditions under which this information may be used, it is the user's responsibility to review the information in the context of the specific intended application an to comply with the federal, state and local government regulations controlling the disposal of the product.

AMC Aus-Det

Hazard Alert Code: NIL

Chemwatch Material Safety Data Sheet
Issue Date: 4-Feb-2010
XC9317TC

CHEMWATCH 6933413
Version No:5

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AMC Aus-Det

PRODUCT USE
Drilling fluid compound, drilling detergent.

SUPPLIER

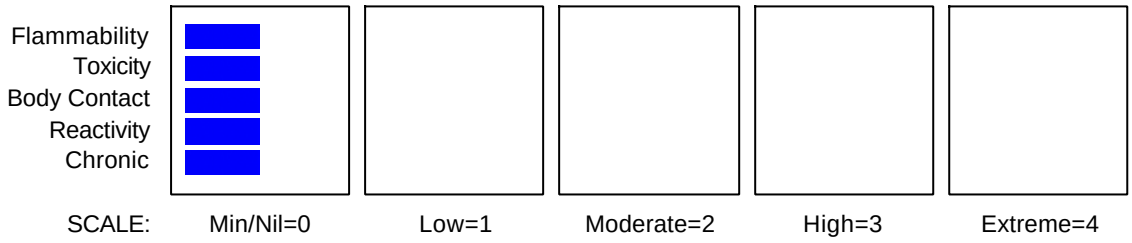
Company: AMC
Address:
5 Pitino Court
Osborne Park
WA, 6017
Australia
Telephone: 61 8 9445 4000
Emergency Tel: **61 400 966 951**
Fax: 61 8 9445 4040

Company: AMC
Address:
PO Box 1141
Osborne Park
WA, 6916
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



RISK
■ May cause long- term adverse effects in the environment.

SAFETY
•None under normal operating conditions.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
polyoxypropylene polyoxyethylene ether		<30
sodium tripolyphosphate	7758-29-4	<10
other nonhazardous ingredients		balance

continued...

Section 4 - FIRST AID MEASURES

SWALLOWED
• If swallowed do NOT induce vomiting.
• If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
• Observe the patient carefully.
• Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

EYE
■ If this product comes in contact with the eyes:
• Wash out immediately with fresh running water.
• Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
• Seek medical attention without delay; if pain persists or recurs seek medical attention.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin or hair contact occurs:
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED
• If fumes or combustion products are inhaled remove from contaminated area.
• Other measures are usually unnecessary.

NOTES TO PHYSICIAN
■ Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• There is no restriction on the type of extinguisher which may be used.
• Use extinguishing media suitable for surrounding area.

FIRE FIGHTING
• Alert Fire Brigade and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves for fire only.
• Prevent, by any means available, spillage from entering drains or water courses.
• Use fire fighting procedures suitable for surrounding area.

FIRE/EXPLOSION HAZARD
• Non combustible.
• Not considered a significant fire risk, however containers may burn.

FIRE INCOMPATIBILITY
■ None known.

HAZCHEM
None

PERSONAL PROTECTION
Glasses:
Chemical goggles.

Gloves:
PVC chemical resistant type.

continued...

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
■ Environmental hazard - contain spillage.
• Clean up all spills immediately.
• Avoid breathing vapours and contact with skin and eyes.
• Control personal contact by using protective equipment.
• Contain and absorb spill with sand, earth, inert material or vermiculite.

MAJOR SPILLS
■ Environmental hazard - contain spillage.
Moderate hazard.
• Clear area of personnel and move upwind.
• Alert Fire Brigade and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves.
• Prevent, by any means available, spillage from entering drains or water course.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Avoid all personal contact, including inhalation.
• Wear protective clothing when risk of exposure occurs.
• Use in a well-ventilated area.
• Prevent concentration in hollows and sumps.

SUITABLE CONTAINER
• Polyethylene or polypropylene container.
• Packing as recommended by manufacturer.
• Check all containers are clearly labelled and free from leaks.
20 litre boxes, 25 litre plastic pails and 205 litre steel drums.

STORAGE INCOMPATIBILITY
■ None known.

STORAGE REQUIREMENTS
• Store in original containers.
• Keep containers securely sealed.
• Store in a cool, dry, well-ventilated area.
• Store away from incompatible materials and foodstuff containers.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS
The following materials had no OELs on our records
• sodium tripolyphosphate: CAS:7758- 29- 4 CAS:15091- 98- 2

PERSONAL PROTECTION


continued...

EYE
- Safety glasses with side shields
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET

■ Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity.
- Wear chemical protective gloves, eg. PVC.
- Wear safety footwear or safety gumboots, eg. Rubber.

OTHER
- Overalls.
- P.V.C. apron.
- Barrier cream.
- Skin cleansing cream.

ENGINEERING CONTROLS

■ General exhaust is adequate under normal operating conditions. If risk of overexposure exists, wear SAA approved respirator.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

Reddish viscous liquid with a mild detergent odour; mixes with water.

PHYSICAL PROPERTIES

Liquid.
Mixes with water.

State	Liquid	Molecular Weight	Not Applicable
Melting Range (°C)	Not Available	Viscosity	Not Available
Boiling Range (°C)	Not Available	Solubility in water (g/L)	Miscible
Flash Point (°C)	Not Applicable	pH (1% solution)	7.0- 8.0
Decomposition Temp (°C)	Not Available	pH (as supplied)	Not Available
Autoignition Temp (°C)	Not Applicable	Vapour Pressure (kPa)	Not Available
Upper Explosive Limit (%)	Not Applicable	Specific Gravity (water=1)	1.02
Lower Explosive Limit (%)	Not Applicable	Relative Vapour Density (air=1)	Not Available
Volatile Component (%vol)	Not Available	Evaporation Rate	Not Available

Section 10 - STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY
- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerisation will not occur.

For incompatible materials - refer to Section 7 - Handling and Storage.

continued...

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS
• Generally not applicable.

CHRONIC HEALTH EFFECTS
• Generally not applicable.

TOXICITY AND IRRITATION

AMC AUS-DET:
■ Not available. Refer to individual constituents.

SODIUM TRIPOLYPHOSPHATE:
■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY
Oral (Rat) LD50: 5190 mg/kg
Dermal (Rabbit) LD50: >3160 mg/kg *

IRRITATION
Nil Reported

■ Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound.

Section 12 - ECOLOGICAL INFORMATION

May cause long-term adverse effects in the environment.
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
AMC Aus- Det	No Data Available	No Data Available		
sodium tripolyphosphate	No Data Available	No Data Available		

Section 13 - DISPOSAL CONSIDERATIONS

• Recycle wherever possible.
• Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
• Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or incineration in a licenced apparatus (after admixture with suitable combustible material).
• Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:
None (ADG7)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: UN, IATA, IMDG

continued...

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE None

REGULATIONS

Regulations for ingredients

sodium tripolyphosphate (CAS: 7758-29-4,15091-98-2) is found on the following regulatory lists;
"Australia High Volume Industrial Chemical List (HVICL)","Australia Inventory of Chemical Substances (AICS)","OECD Representative List of High Production Volume (HPV) Chemicals"

No data for AMC Aus-Det (CW: 6933413)

Section 16 - OTHER INFORMATION

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
sodium tripolyphosphate	7758-29-4, 15091-98-2

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Issue Date: 4-Feb-2010
Print Date: 24-May-2011

This is the end of the MSDS.

MATERIAL SAFETY DATA SHEET

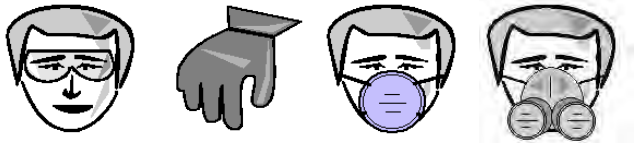
AUS−GEL XTRA

HAZARDOUS*

Substance:	Aus−Gel Xtra	Approved Criteria Classification:	Not allocated
Trade Names:	Bentonite, sodium montmorillonite	SUSDP Classification:	Not allocated
Product Use:	Drilling fluids compound, viscosifyer. Change of Revision due to document review only.	ADG:	Not allocated
Creation Date:	21−Nov−2001	UN Number:	0
Revision Date:	21−Mar−2006		

* According to the criteria of NOHSC

Quick Summary*

General Properties:	Powder, Grey/tan, Odourless
Major Health Hazards:	Prolonged inhalation of silica dust has been known to cause silicosis and other effects.
PPE:	
Extinguishing Media:	Carbon dioxide, dry chemicals, water.
Environment:	Wear protective equipment to prevent skin and eye contamination. Contain the spill. Prevent any accidental release from entering stormwater drains and reaching exposed surface areas. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent. Shovel/scrape into containers for disposal.
Disposal:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent. Shovel/scrape into containers for disposal.

Handling and Storage

Storage:	Store in a dry area. Keep dust to a minimum. Product slippery when wet.
Exposure Limits:	OSHA Pel(8hr TWA) ACGIH TLV Total dust 10 mg/m3 ND Respir dust 5mg/m3 ND Crystalline 0.1mg/m3 0.1mg/m3 (quartz) Although the typical quartz content of bentonite is in the range of 2% to 6%, most of the quartz particles are larger than 10 u respirable threshold size. The actual respirable quartz concentration in airborne bentonite dust will depend upon bentonite sources, fineness of product, moisture content of product, local humidity and wind conditions at point of use and other specific factors.
Ventilation:	Use in well ventilated areas.
Eye Protection:	

Skin Protection:	 Rubber or PVC
Repiratory Protection:	  (AS1715, AS1716) Refer "Other information"
Protective Material Types:	RECOMMENDED: Barrier cream. Wear loose comfortable clothing. Avoid generating dust and clean work area regularly.

First Aid Measures

Scheduled Poisons:	Not allocated
Inhalation:	Remove to fresh air
Skin Contact:	Wash with soap and water.
Eye Contact:	Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Seek immediate medical assistance.
Ingestion:	INDUCE VOMITING. Drink water to dilute.

Potential Health Effects

Inhalation:	Prolonged inhalation of silica dust has been known to cause silicosis and other effects.
Skin Contact:	Wash with soap and water.
Eye Contact:	May cause mechanical eye irritation if dust is excessive.
Ingestion:	INDUCE VOMITING. Drink water to dilute.
Carcionogen (NOHSC, NTP, IARC):	Prolonged inhalation of silica dust has been known to cause silicosis and other effects.
Major Health Hazards Summary:	Prolonged inhalation of silica dust has been known to cause silicosis and other effects.

Fire Fighting Measures

Fire and Explosion Hazards:	Not flammable or explosive.
Extinguishing Media:	Carbon dioxide, dry chemicals, water.
Fire Fighting Instructions:	Not available
Flash Point:	Not available

Accidental Release Measures

Occupational Release:	Wear protective equipment to prevent skin and eye contamination. Contain the spill. Prevent any accidental release from entering stormwater drains and reaching exposed surface areas. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other absorbent. Shovel/scrape into containers for disposal.

Environmental Information

Accidental Release:	Prevent any accidental release from entering stormwater drains and reaching exposed surface areas.
Environmental Risk Rating (EU Rating):	Not available
Environmental Toxicity:	Not available
Disposal Considerations:	DO NOT DISPOSE IN NORMAL WASTE BINS. Dispose of contaminated material into a registered disposal location in accordance with relevant legislation. Sweep up dry spillages. The addition of water or rain will increase the difficulty to clean up any spill. Where the product becomes wet or is a gel, add sand, soil, or other

	absorbent. Shovel/scrape into containers for disposal.

Toxicological Information

Ingredients	***CAS Number***	***Proportion***
Sodium montmorillonite	1302−78−9	>98%
Polyacrylamide	Not allocated	<0.5%
Soda ash	497−19−18	<0.5%
Silica (quartz)	14808−60−7	<15%

Individual Ingredient Information	
Sodium montmorillonite	
Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available
Polyacrylamide	
Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available
Soda ash	
Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available
Silica (quartz)	
Irritation Data:	Not available
Toxicity Data:	Not available
Local Effects:	Not available
Acute Toxicity Level:	Not available
Target Organs:	Not available
Mutagenic Data:	Not available
Reproductive Effects Data:	Not available
Other:	Not available

Physical and Chemical Properties

Physical State:	Powder	Specific Gravity:	2.4 − 2.8
Colour:	Grey/tan	Water Solubility:	Insoluble (forms colloidal suspension)
Odour:	Odourless	pH:	8−9 (5% aqueous suspension)
Boiling Point:	Not available	Volatility:	Not available
Freezing Point:	1450 degrees celsius (approx)	Odour Threshold:	Not available
Vapour Pressure:	Not available	Evaporation Rate:	Not available
Vapour Density:	Not available	Coefficient of Water/Oil Distrib:	Not available

Stability and Reactivity

Reactivity:	Not available
Conditions to Avoid:	Not available
Incompatibilities:	Not available
Hazardous Decomposition:	Not available
Polymerization:	Not available

Transport Information

ADG Code:	Not allocated
Hazchem Code:	Not allocated
Special Provision:	Not allocated
Packaging Group:	0
Packaging Method:	Not allocated

Regulatory Information

Significant Legislation:	Not available

Other Information

Contact Point:	Australian Mud Company Phone +61 8 9445 4000 mobile 0409 114 627
Other Information:	The information presented in this MSDS was obtained from recognised published data and is as accurate as possible. Since Australian Mud Company Pty Ltd cannot anticipate the conditions under which this information may be used, it is the user's responsibility to review the information in the context of the specific intended application an to comply with the federal, state and local government regulations controlling the disposal of the product. QUARTZ LEVEL SUITABLE RESPIRATOR AS/NZS 1715 Under 0.2 mg/m3 respirator optional Up to 2mg/m3 − class P1 filter Up to 10mg/m3 − class P3 filter in full facepiece Over 10mg/m3 − airline respirator positive pressure full face piece PAPR with class P3 filter, full face piece or head covering & blouse

AMC AUS-GEL

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AMC AUS-GEL

SYNONYMS
"drilling fluid", viscosifier

PRODUCT USE
Drilling fluid compound; viscosifier.

SUPPLIER

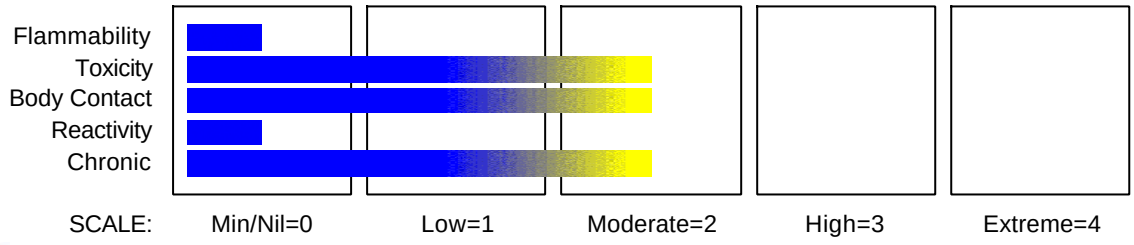
Company: AMC
Address:
5 Pitino Court
Osborne Park
WA, 6017
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Company: AMC
Address:
PO Box 1141
Osborne Park
WA, 6916
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



RISK
■ Irritating to eyes, respiratory system and skin.

SAFETY
• Do not breathe dust.

• Avoid contact with skin.
• Wear eye/face protection.
• To clean the floor and all objects contaminated by this material, use water and detergent.
• In case of contact with eyes, rinse with plenty of water and contact Doctor or Poisons Information Centre.
• If swallowed, IMMEDIATELY contact Doctor or Poisons Information Centre. (show this container or label).

continued...

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
bentonite	1302-78-9	>98
polyacrylamide		NotSpec

Section 4 - FIRST AID MEASURES

SWALLOWED
• If swallowed do NOT induce vomiting.
• If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
• Observe the patient carefully.
• Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

EYE
■ If this product comes in contact with the eyes:
• Wash out immediately with fresh running water.
• Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
• Seek medical attention without delay; if pain persists or recurs seek medical attention.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin or hair contact occurs:
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED
• If dust is inhaled, remove from contaminated area.
• Encourage patient to blow nose to ensure clear breathing passages.
• Ask patient to rinse mouth with water but to not drink water.
• Seek immediate medical attention.
• If fumes or combustion products are inhaled remove from contaminated area.
• Lay patient down. Keep warm and rested.
• Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
• Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.

NOTES TO PHYSICIAN
■ Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• There is no restriction on the type of extinguisher which may be used.
• Use extinguishing media suitable for surrounding area.

FIRE FIGHTING
• Alert Fire Brigade and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves for fire only.
• Prevent, by any means available, spillage from entering drains or water courses.
• Use fire fighting procedures suitable for surrounding area.

FIRE/EXPLOSION HAZARD
• Non combustible.
• Not considered a significant fire risk, however containers may burn.

FIRE INCOMPATIBILITY
■ None known.

continued...

HAZCHEM
None

Personal Protective Equipment
Gloves, boots (chemical resistant).
Breathing apparatus.

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
• Remove all ignition sources.
• Clean up all spills immediately.
• Avoid contact with skin and eyes.
• Control personal contact by using protective equipment.

MAJOR SPILLS
■ Moderate hazard.
• CAUTION: Advise personnel in area.
• Alert Emergency Services and tell them location and nature of hazard.
• Control personal contact by wearing protective clothing.
• Prevent, by any means available, spillage from entering drains or water courses.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Limit all unnecessary personal contact.
• Wear protective clothing when risk of exposure occurs.
• Use in a well-ventilated area.
• Avoid contact with incompatible materials.

SUITABLE CONTAINER
• Polyethylene or polypropylene container.
• Check all containers are clearly labelled and free from leaks.

STORAGE INCOMPATIBILITY
■ None known.

STORAGE REQUIREMENTS
• Store in original containers.
• Keep containers securely sealed.
• Store in a cool, dry area protected from environmental extremes.
• Store away from incompatible materials and foodstuff containers.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS
The following materials had no OELs on our records
• bentonite: CAS:1302- 78- 9 CAS:11004- 12- 9

PERSONAL PROTECTION




continued...

RESPIRATOR
Particulate

EYE
- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET
- Wear chemical protective gloves, eg. PVC.
- Wear safety footwear or safety gumboots, eg. Rubber.

OTHER
- Overalls.
- P.V.C. apron.
- Barrier cream.
- Skin cleansing cream.

ENGINEERING CONTROLS
■ Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Grey/tan odourless powder; insoluble in water.

PHYSICAL PROPERTIES
Does not mix with water.

State	Divided Solid	Molecular Weight	Not Applicable
Melting Range (°C)	Not Available	Viscosity	Not Applicable
Boiling Range (°C)	Not Available	Solubility in water (g/L)	Immiscible
Flash Point (°C)	Not Applicable	pH (1% solution)	Not Available
Decomposition Temp (°C)	Not Available	pH (as supplied)	Not Applicable
Autoignition Temp (°C)	Not Applicable	Vapour Pressure (kPa)	Not Applicable
Upper Explosive Limit (%)	Not Applicable	Specific Gravity (water=1)	Not Available
Lower Explosive Limit (%)	Not Applicable	Relative Vapour Density (air=1)	Not Applicable
Volatile Component (%vol)	Not Applicable	Evaporation Rate	Not Applicable

Section 10 - STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY
- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerisation will not occur.

For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS
ACUTE HEALTH EFFECTS
■ Irritating to eyes, respiratory system and skin.

CHRONIC HEALTH EFFECTS
■ Not applicable.

TOXICITY AND IRRITATION
AMC AUS-GEL:
■ Not available. Refer to individual constituents.

continued...

BENTONITE:
■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY IRRITATION
Intravenous (Rat) LD50: 35 mg/kg
Intravenous (Dog) LD: 10 mg/kg
■ Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound.
No significant acute toxicological data identified in literature search.
for bentonite clays:
Bentonite (CAS No. 1302-78-9) consists of a group of clays formed by crystallisation of vitreous volcanic ashes that were deposited in water.<</>.

Section 12 - ECOLOGICAL INFORMATION

No data
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

Section 13 - DISPOSAL CONSIDERATIONS

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:
None (ADG7)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: UN, IATA, IMDG

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE None

REGULATIONS

Regulations for ingredients

bentonite (CAS: 1302-78-9,11004-12-9) is found on the following regulatory lists;
"Australia High Volume Industrial Chemical List (HVICL)","Australia Inventory of Chemical Substances (AICS)","International Fragrance Association (IFRA) Survey: Transparency List","OECD Representative List of High Production Volume (HPV) Chemicals"

No data for AMC Aus-Gel (CW: 42071)

Section 16 - OTHER INFORMATION

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
bentonite	1302-78-9, 11004-12-9

continued...

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Issue Date: 11-Feb-2010
Print Date: 28-Jan-2011

This is the end of the MSDS.

AMC AUS-FLOC C

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
AMC AUS-FLOC C

PRODUCT USE
Cationic flocculant.

SUPPLIER

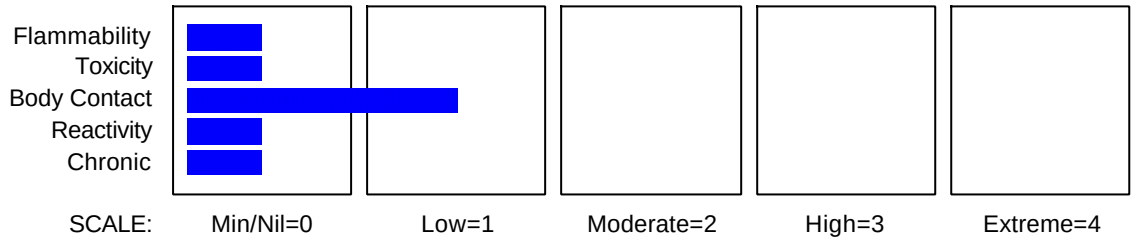
Company: AMC
Address:
5 Pitino Court
Osborne Park
WA, 6017
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Company: AMC
Address:
PO Box 1141
Osborne Park
WA, 6916
Australia
Telephone: +61 8 9445 4000
Emergency Tel:**+61 400 966 951**
Fax: +61 8 9445 4040

Section 2 - HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE
NON-HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to NOHSC Criteria, and ADG Code.

CHEMWATCH HAZARD RATINGS



RISK
•None under normal operating conditions.

SAFETY
•None under normal operating conditions.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
nonhazardous ingredients		100

Section 4 - FIRST AID MEASURES

SWALLOWED
• Immediately give a glass of water.
• First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

continued...

EYE
■ If this product comes in contact with eyes:
• Wash out immediately with water.
• If irritation continues, seek medical attention.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin or hair contact occurs:
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED
• If dust is inhaled, remove from contaminated area.
• Encourage patient to blow nose to ensure clear passage of breathing.
• If irritation or discomfort persists seek medical attention.

NOTES TO PHYSICIAN
■ Treat symptomatically.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• There is no restriction on the type of extinguisher which may be used.
• Use extinguishing media suitable for surrounding area.

FIRE FIGHTING
• Alert Fire Brigade and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves for fire only.
• Prevent, by any means available, spillage from entering drains or water courses.
• Use fire fighting procedures suitable for surrounding area.

FIRE/EXPLOSION HAZARD
• Non combustible.
• Not considered a significant fire risk, however containers may burn.
Decomposes on heating and produces toxic fumes of: carbon monoxide (CO), carbon dioxide (CO_2), hydrogen chloride, phosgene, nitrogen oxides (NOx).

FIRE INCOMPATIBILITY
■ None known.

HAZCHEM
None

PERSONAL PROTECTION

Glasses:	Respirator:
Chemical goggles.	Particulate

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
• Clean up all spills immediately.
• Avoid breathing dust and contact with skin and eyes.
• Wear protective clothing, gloves, safety glasses and dust respirator.
• Use dry clean up procedures and avoid generating dust.

MAJOR SPILLS
■ Moderate hazard.
• CAUTION: Advise personnel in area.
• Alert Emergency Services and tell them location and nature of hazard.
• Control personal contact by wearing protective clothing.
• Prevent, by any means available, spillage from entering drains or water courses.

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

continued...

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Avoid all personal contact, including inhalation.
• Wear protective clothing when risk of exposure occurs.
• Use in a well-ventilated area.
• Prevent concentration in hollows and sumps.
Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.
• Do NOT cut, drill, grind or weld such containers.
• In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

SUITABLE CONTAINER
• Lined metal can, lined metal pail/ can.
• Plastic pail.
• Polyliner drum.
• Packing as recommended by manufacturer.

STORAGE INCOMPATIBILITY
■ None known.

STORAGE REQUIREMENTS
• Store in original containers.
• Keep containers securely sealed.
• Store in a cool, dry, well-ventilated area.
• Store away from incompatible materials and foodstuff containers.
Storage temperature: 0-35 deg C.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

PERSONAL PROTECTION



RESPIRATOR
Particulate

EYE
• Safety glasses with side shields.
• Chemical goggles.
• Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET
■ Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.
• polychloroprene
• nitrile rubber
• butyl rubber
• fluorocaoutchouc.

continued...

OTHER
- Overalls.
- P.V.C. apron.
- Barrier cream.
- Skin cleansing cream.

ENGINEERING CONTROLS
- Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
- If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered.

Such protection might consist of:
(a): particle dust respirators, if necessary, combined with an absorption cartridge;
(b): filter respirators with absorption cartridge or canister of the right type;
(c): fresh-air hoods or masks.
Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
White odourless solid; soluble in water.

PHYSICAL PROPERTIES
Mixes with water.

State	Divided Solid	Molecular Weight	Not Applicable
Melting Range (°C)	Not Available	Viscosity	Not Applicable
Boiling Range (°C)	Not Applicable	Solubility in water (g/L)	Miscible
Flash Point (°C)	Not Applicable	pH (1% solution)	Not Available
Decomposition Temp (°C)	Not Available	pH (as supplied)	2.5- 4.5 @ 5 g/L
Autoignition Temp (°C)	Not Applicable	Vapour Pressure (kPa)	Not Applicable
Upper Explosive Limit (%)	Not Applicable	Specific Gravity (water=1)	Not Available
Lower Explosive Limit (%)	Not Applicable	Relative Vapour Density (air=1)	Not Applicable
Volatile Component (%vol)	Not Applicable	Evaporation Rate	Not Applicable

Section 10 - STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY
■ Product is considered stable and hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS
■ Not applicable.

CHRONIC HEALTH EFFECTS
■ Not applicable.

TOXICITY AND IRRITATION
AMC AUS-FLOC C:
■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY
Oral (Rat) LD50: >5000 mg/kg

IRRITATION

continued...

Section 12 - ECOLOGICAL INFORMATION

No data
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

Section 13 - DISPOSAL CONSIDERATIONS

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM:
None (ADG7)

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: UN, IATA, IMDG

Section 15 - REGULATORY INFORMATION

POISONS SCHEDULE None

REGULATIONS

No data for AMC Aus-Floc C (CW: 4744-31)

Section 16 - OTHER INFORMATION

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Issue Date: 19-Nov-2009
Print Date: 28-Jan-2011

This is the end of the MSDS.

Appendix F

Further information regarding drilling fluids

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AGL Energy Limited
ABN: 74 115 061 375

Level 22, 101 Miller St
North Sydney NSW 2060

Locked Bag 1837
St Leonards NSW 2065

T: 02 9921 2999
F: 02 9921 2552
www.agl.com.au

A few words.

Appendices F:
Further information regarding drilling fluids
PEL 285- Proposed Reservoir Coreholes Review of Environmental Factors

26 October 2011

NSW Trade & Investment – Resources & Energy
Manager – Environmental Operations
PO Box 344
Hunter Regional Mail Centre NSW 2310

Re: Reservoir Corehole REF - Drilling Fluid and Lubricant Additives - Outline of Potential Environmental Impacts

The purpose of this letter is to provide further detail on the drilling fluid and lubricant additives (**Additives**) that will potentially be used during the drilling process for the proposed exploration Reservoir Corehole project (**Project**). This letter is intended to supplement the REF for Proposed Exploration Reservoir Corehole.

Not all of the Additives referred to in this letter will be used during the drilling process for the Reservoir Corehole, however for completeness, this letter addresses all Additives which could potentially be used.

This letter:

- provides a list of all Additives that will potentially be used for the drilling component of the Project;
- attaches statements from the companies supplying the Additives which address the environmental impacts for those Additives;
- outlines the risk of potential environmental impacts from the Additives, and mitigation measures/management controls proposed to minimise potential impacts.

AGL's Drilling Fluid Additives

Water based Additives (otherwise referred to as "drilling based mud" or "mud") are used during the drilling process to:

- maintain well control (that is, the pressure exerted by the mud on the formation is greater than the pressure within that formation to avoid any reservoir fluids flowing into the wellbore during drilling);
- effectively bring the drill cuttings to surface to avoid any drilling components becoming stuck if the cuttings build up around the equipment;
- cool and lubricate the "bit" of the drill; and
- ensure that the hole maintains integrity throughout the drilling operation and avoid any swelling of any clays within formations that are being drilled.

The properties of drilling mud are designed in order to ensure that these criteria/uses are best achieved.

During the drilling process, the Additives are mixed on the surface, pumped down the well hole and returned to the surface with drill cuttings and captured in enclosed tanks/pits.

AGL Energy does not use BTEX additives as part of its drilling based mud or lubricants. The Additives proposed to be used for the Project (that AGL typically uses for its various CSG drilling operations) are water based and simplistic in nature. Table 1 provides a full list of the drilling additives that could potentially be used for the Project.

Table 1: Drilling Fluid additives used by AGL. Fluids outlined below are those intended for the Corehole drilling

Drilling Fluid Additives for Camden, Hunter and Gloucester (all water based fluid systems)					
Trade Name	**Supplier**	**Material / Chemical Description**	**Basic Function**	**Typical Concentration**	**MSDS**
AMC / Aus-Gel Xtra	AMC	Bentonite polyarcrylamide	Increases fluid viscosity and reduces fluid loss. Increases hole stability and hole cleaning	15 - 30 kg per 1000 litres of water	AMC Aus-Gel Xtra MSDS
AMC or Redox / Biocide	AMC or Redox	Water propylene glycol	Prevent bacteria build up in the drilling fluid	5 litres per 1000 liters of fluid	AMC Biocide MSDS
AMC / PAC L	AMC	polyanionic cellulose	Reduces fluid loss without increasing viscosity	2 - 5 kg per 1000 litres of water	AMC PAC L MSDS
AMC or Redox / PAC R	AMC or Redox	polyanionic cellulose	Reduces fluid loss and increases viscosity	1.5 - 2.5kg per 1000 litres of water	AMC PAC R MSDS Redox Pty Ltd - Material Safety Data Sheet POANCE30
Redox / Casutic Soda	Redox	Sodium hydroxide	Raise the pH of the fluid	0.25 - 1.5kg per 1000 litres of water	Redox Pty Ltd - Material Safety Data Sheet CASODI
Redox / Guar Gum		Guar gum	Increase viscosity and soilds suspension	1 - 3 kg per 1000 litres of water	Redox Pty Ltd - Material Safety Data Sheet GUGUAR
AMC or Redox / Potassium Chloride	AMC or Redox	Potassium Chloride	Shale and clay stabilisation. Weighting agent	10 - 30 kg per 1000 litres of water	Redox Pty Ltd - Material Safety Data Sheet POCHLA
Redox / Potassium Sulphate	Redox	Potassium Sulphate	Shale and clay stabilisation	30 - 40 kg per 1000 litres of water	Redox Pty Ltd - Material Safety Data Sheet POSUPH
Redox / Sodium Bicarbonate		Sodium Bicarbonate	Lower the pH of the fluid	0.25 - 5kg per 1000 litres of water	Redox Pty Ltd - Material Safety Data Sheet SOBICA
SAPP	Rheochem	Sodium Acid Pyro Phosphate	Used to remove wellbore filter cake prior to cementing	8.5 to 14kg per 1000L	Rheochem SAPP MSDS
Barite		Barium Sulfate	weighting agent	142 to 180kg per 1000L	Rheochem Barite MSDS
Citric Acid		-	pH Control	0.71kg per 1000L	Rheochem Citric Acid MSDS
Soda Ash		Sodium Carbonate	Treat and calcium hardness in make up water	0.71kg per 1000L	Rheochecm Soda Ash MSDS
Idcide 20		Tetrakis Hydroxymethyl Phosponium Sulfate (THPS)	prevent bacterial degradation of fluid system	1 to 4kg per 1000L	Rheochecm Icdide-20 MSDS
Rheoben NT		Water absorbent Clay. Montmorillonite	Common Viscosifier / Fluid Loss control	40 to 52kg per 1000L	Rheochem Rheoben NT MSDS
Xanthum Gum P		Corn Based biopolymer	Viscosifier	2 to 6kg per 1000L	Rheochem Xanthum Gum P MSDS
Quickseal	AMC	organic cellulose fibre	product used to cure lost	60kg per 1000L	AMC Quickseal MSDS
Xtra Sweep		polypropylene	additive used to provide	25kg per 1000L	AMC Xtrasweep MSDS
Defoamer		poly glycol	foam reducing agent	0.10%	AMC Defoamer MSDS
CR650 (PHPA)	AMC	Acrylamide co polymer,	clay inhibitor & core	1 to 2.5kg per 1000L	AMC CR650 MSDS
FS2000	FluidStar	polysaccharide and	Liquid polymer	1 to 2L per 1000L	FluidStar FS2000 MSDS
Ausgel		bentonite	Increases fluid viscosity	15 to 30kg per 1000L	AMC Aus-Gel Xtra MSDS
FracSeal	AMC	organic cellulose fibre	Assist with fluid loss and filter cake development	60kg per 1000L	AMC FracSeal M MSDS
Residrill		Organic polymers	Fluid Loss control	11kg per 1000L	AMC ResiDrill MSDS
Aus Det		Concentrated blend of detergents	improves the drilling characteristics of low solids and	1-5L per 1000L	AMC Aus-Det MSDS

Please note that not all these products listed will be used during the corehole drilling process. The complete list of additives includes some contingencies based on drilling parameter contingency requirements.

The suppliers of the drilling additives may change at any given time. Suppliers may use different trade / brand names for the same chemical.

The attached schedule outlines the following properties (amongst others) for each of the above Additives**:**

- Toxicity
- BTEX testing
- Environmental considerations
- Functions/purpose

Risk of Potential Environmental Impacts

In principle, the volume of lubricants used for drilling or maintenance operations is miniscule.

The concentrations of the Additives used in the drilling mud pose minimal or negligible risk to the environment or health if they are handled, stored and disposed of correctly, as per the instructions and MSDS. There is limited or no chance of prolonged exposure to these chemicals/additives during the drilling process when handled and disposed of correctly, as there is minimal handling.

As BTEX products are not used during the drilling of a well or in the fracturing of a well at AGL, in the unlikely event of leakage occurring, this does not present a health or environmental risk arising from exposure to any BTEX components.

In terms of potential groundwater contamination, during the drilling of shallow aquifers (referred to as the surface hole) lost circulation of Additives is typically not experienced or observed. That is, drilling fluid is typically not lost into the formation. This is because Additives are pumped down the well hole, and then pumped back out again. Lost circulation would indicate that a feed rate into an aquifer has been established. As most aquifers drilled through at Gloucester have low permeability, there are typically no fluid losses seen during the drilling process. These shallow formations and aquifers are then isolated by surface casing thta is pressure cemented in place.

Drilling Contractor Lubricants

Small amounts of lubricants are used onsite by the drilling contractors to maintain all the surface equipment used to undertake the drilling of the wells. Pipe lubricant (commonly referred to as “dope”) may be exposed to the wellbore during drilling or maintenance operations (workovers or completions). Pipe lubricant is BTEX free and only minimal amounts are used (brushed onto the threads for protection as they are made up to run the drill pipe into the wellbore).

The quantities of drilling lubricants used are extremely low, to the point of insignificance. Any amount of pipe lubricant on the surface of any pipe is residual.

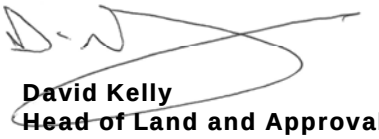
Mitigation Measures for Drilling Fluids and Contractor Lubricants

In addition to the mitigation measures described in the REF and above, measures that will be in place to ensure that the potential for soil, surface water or groundwater contamination to occur is minimised include:

- Lined and bunded area for storage of all oil/lubricant and additives.
- Clearly labelled containers/storage.
- MSDS onsite for handling the additives/chemicals.
- Spill kits located throughout the site.
- Double skinned tanks for fuel storage.
- Additives/Chemicals are blended in a controlled environment into enclosed tanks.
- Appropriate location for storage (that is, no near any sensitive areas identified during Environmental planning).
- The shallow surface formations and aquifers (typically <120m on most CSG wells) are protected during drilling to the coals by rated casing and specifically designed cement.
- Drill fluid volumes are monitored at all times throughout the operation allowing fast reaction times to any fluid loss into any formations that may be observed.

Overall, if handling and storage is correctly carried out and the management strategies /mitigation measures proposed are implemented, then the risk of adverse impacts to surface water, groundwater and soil from Drilling fluids and lubricants will be minimal.

Yours sincerely,



David Kelly
Head of Land and Approvals
Upstream Gas

Schedule 1

AGL is taking action toward creating a sustainable energy future for our investors, communities and customers. Key actions are:

- Being selected as a member of the Dow Jones Sustainability Index 2006/07
- Gaining accreditation under the National Green Power Accreditation Program for AGL Green Energy®, AGL Green Living® and AGL Green Spirit
- Being selected as a constituent of the FTSE4Good Index Series

RHEOCHEM
A Newpark Company

CHEMICAL FACT SHEET - AGL DRILLING OPERATIONS

Energy in action

Rheochem Trade Name	Other Trade Names	Material / Chemical Description	Other Industries	HAZCHEM? (Code)	Toxicity	Environmental Considerations	Independent BTEX Tested	Handling (Consult MSDS for handling and PPE)	Unit Size	Typical Concentration used (kg/m³)	Max Kept on Site (kg)	Basic Function	Purpose / Use
K2S04	Potassium Sulphate	Sulphuric Dipotassium Salt, Sulphate of Potash, Potash of Sulfur, Arcanite	Fertiliser for chloride sensitive crops.	No	Low, moderate if coming into contact with eyes.	None	YES - No detectable levels of BTEX recorded	Avoid Inhaling Dust. Store in well ventilated area.	25 kg Sack	36.0 - 52.0	400	Clay Inhibitor	Helps to keep the drilled clays dry and less sticky.
Rheoben NT	Bentonite, Maxigel, Aus-Gel, Trugel 13A, Gel	Water absorbent Clay. Montmorillonite. Naturally occurring clay mineral in Australia.	Landfills (to prevent leaching). Soil rehabilitaion for rice farming. Cosmetics.	No	Low	None	YES - No detectable levels of BTEX recorded	Avoid Inhalation	25 kg Sack	45.7 - 51.4	0	Common Viscosifier / Fluid Loss control (Currenlty not programmed for Exoma)	Thickens the mud so it can carry the drilled rock out of the hole. Also forms a "wall cake" on the side of the hole to prevent mud from leaching into the ground.
Xanthan Gum P	Flowzan	Corn Based biopolymer (polysaccharide)	Food grade version sare used as binders and thickeners.	No	Low	None	YES - No detectable levels of BTEX recorded	Avoid Inhalation	25 kg Sack	1.4 - 5.7	80	Viscosifier	Thickens the mud so it can carry the drilled rock out of the hole.
Rheopac	Rheopac-RD, Rheopac-LV, Rheopac-R, Drispac-R, Drispac-SL, PAC-R, PAC-L	Poly Anionic Cellulose	Poly-anionic cellulose or PAC is derived from Carboxymethyl cellulose (CMC) where the food grade version is used in the manufacture of icecream. Non-food uses include KY Jelly, toothpaste,diet pills etc.	No	Low	Low Biodegradability	YES - No detectable levels of BTEX recorded	Avoid Inhalation	25 kg Sack	1.4 - 3.4	80	Fluid Loss Control	Reduces the amount of fluid seepage from the mud into the ground which can cause the hole to become sticky, unstable and less productive.
Idcide - 20		Tetrakis Hydroxymethyl Phosponium Sulfate (THPS)	Biodegradable and non-bioaccumalative microbiocide.	No	Low to Moderate irritant for Skin, to Inhale or Ingest. Severe irritant in contact with eyes.	Toxic to microorganisms in short term, but biodegradable and non-bioaccumlative	YES - No detectable levels of BTEX recorded	Liquid Product. Contain if spilled.	20 kg Drum	0.28 - 0.71	32	Biocide	To prevent micro-organisms from attacking the mud and to stop the sump from going green and starting to smell.
Sodium Bicarbonate	Generic Product	Sodium Hydrogen Carbonate (NaHC03)	Food grade version is a major ingredient of Baking Soda.	No	Low	None	YES - No detectable levels of BTEX recorded	Avoid Inhalation	25 kg Sack	0.71	48	pH Control / Cement Treatment	Treatment against cement contamination of the drilling mud.
CITRIC ACID	Generic Product	-	Food grade version is used for flavouring in beverages, jams, jellies and candy.	Yes (N/A)	Low. Slight irritant to eyes and skin or if inhaled or ingested.	None	YES - No detectable levels of BTEX recorded	Avoid Skin, Eyes and Lung Exposure	25 kg Sack	0.71	40	pH Control / Stuck Pipe	to reduce pH, or to mix in a Citric SAPP pill if the drillpipe gets stuck in the hole.
SODA ASH	Generic Product	Sodium Carbonate (Na2C03)	Food grade version used in water treatment for hardness. Manufacturing of Glass. General cleanser.	No	Slightly Corrosive - Irritant	pH	YES - No detectable levels of BTEX recorded	Avoid Inhalation	25 kg Sack	0.71	48	Hardness Treatment	Control of Calcium Hardness.
CAUSTIC SODA (Drums)	Generic Product	Sodium Hydroxide	Strong Base. Used for manufacturing soaps.	Yes	High. Severe irritant to eyes and skin or if inhaled or ingested.	Corrosive, high pH - disperses quickly	YES - No detectable levels of BTEX recorded	Store away from Acids. Avoid contact with Skin, Eyes and Lungs.	25 kg Can	0.71	32	pH Control	to increase pH
SAPP	Disodium Pyrophosphate	Sodium Acid Pyro Phosphate	Food grade version used in baking powders.	No	Low to Moderate Irritant.	None	YES - No detectable levels of BTEX recorded	Avoid Inhaling Dust. Store in well ventilated area.	25 kg Sack	8.5 - 14.2	40	Stuck Pipe Agent	Used with Citric Acid to free pipe from side of the hole. Also used to clean bentonite from the holw when finished drilling.
DEFOAM - E	-	Polyoxyethylene polyoxypropylene block copolymer	-	No	Low to moderate irritant if in contact with eyes. Over exposure may irritate nose and throat.	Not readily biodegradable	YES - No detectable levels of BTEX recorded	Liquid Product. Contain if spilled.	25 L Drum	0.08	32	Defoaming Agent	Prevent foaming of mud and problems with pumps.
Barite	Rheobar, Aus-Bar	Barite, Barium Sulfate. Naturally occurring, insoluble mineral.	Medical - eg passed through digestive system to X-Ray digestive problems. Used in the manufacture of paper and paint.	No	Low	None	YES - No detectable levels of BTEX recorded	Avoid Inhaling Dust. Store in well ventilated area.	25 kg Sack	142 - 180	320	Weighting Material	To prevent hole collapsing and high pressure gas or water from escaping (ie "Blowout"). Legal Requirment for "Well Control".

Updated September 2011

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6th September 2011

RE: BTEX TESTING

James,

Rheochem can verify that all product types that are supplied to the CSG operators out of our Roma and Brisbane warehouse facilities have been tested by independent laboratories for BTEX and Rheochem can confirm that ***no detectable levels of BTEX*** were found.

Rheochem commenced BTEX testing on its products by independent laboratories in November 2010 and has implemented an ongoing regular testing procedure as a standard for all product type supplied in Queensland.

It was through this first round of testing that Rheochem identified certain product types which contained trace amounts of BTEX in the raw materials and removed them immediately from both the Roma and Brisbane warehouse facilities aswell as inspecting all rigsites to ensure these products were not present in the field. Rheochem has now sourced and tested new alternative product types to replace the products removed. In doing this Rheochem can still offer a full range of drilling fluid chemicals to our customers which have been tested and found to have no detectable levels of BTEX.

Rheochem can supply full testing BTEX results certificates for each product type on request.

Yours sincerely

Dave Bennett
Managing Director

From: Thomas Reinbold [Reinbold@bestolife.com]
Sent: Wednesday, 7 September 2011 2:24 AM
To: Alex Whiteside
Subject: Re: BTEX Enquiry

Alex,

None of the Bestolife products, including the 2000, contain any BTEX. Lubricating oils, used in Bestolife products pass a test that is performed to determine whether an oil contains carcinogens. The results of the test confirm that no benzene, toluene, ethylene, or xylene exist.

We appreciate your business and continued support in Bestolife products. If you have any questions or if we can be of any additional assistance, please let us know.

Regards

Thomas

From: Alex Whiteside <AWhiteside@agl.com.au>
To: Thomas Reinbold
Sent: Tue Sep 06 01:54:22 2011
Subject: BTEX Enquiry

Hello Thomas,

My name is Alex Whiteside, I am a drilling engineer working for AGL Energy in Sydney, Australia. We are drilling a coal seam gas production field in Southern Sydney.

At the moment there is a spotlight on the industry and the chemicals used. We have been asked to confirm what products we use contain BTEX (benzene, toluene , ethylbenzene and xylene).

We currently use your Best of Life 2000 and API Modified products. Could you please confirm whether these or any of your products contain BTEX?

Thanks and Regards,

Energy in action.™

AGL

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